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Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America.

By JOHN C. TRAUTWINE, Civ. Eng., Philad.

Continued from page 226.

THE RIVER SAN JUAN. I made the length of this river, from San Pablo to the Pacific at Chirambirá, 123 miles.

From the Surúcco to the San Augustín, its average width is about 200 yards. At a few points, however, it is contracted to within half that limit, as at about a league below the Tamaná. Below the San Augustín, both the widths and the depths are, by degrees, considerably increased, the former being frequently 300 yards.

Having found Colonel Acosta's map of the Atrato quite accurate, even in the position of the most important bends, I somewhat too hastily assumed that his delineation of the San Juan was equally so. But as we approached the ocean, the discrepancies between the distances taken from his map, and those reduced from our own observations by time and rate of motion, convinced me that he was in error; more especially as I found also, that his map did not exhibit some important bends which I had noted. Consequently, at the mouth of the Munguidó, or 38 miles above Chirambirá, I commenced taking the courses also; and my protraction of this portion shows that the want of coincidence between his map of the San Juan and mine, as regards the length of that river, is satisfactorily accounted for by his inattention to the details of its sinuosities.

We generally found the current to be about three miles an hour, until some distance below Noanamá, where it gradually diminishes.

There are several islands in the river. The longest is that extending from the San Augustín to the Todó, a distance of a league. They are all low and flat. Like the Atrato, the San Juan is bordered by natural levees, backed by swamps. In the upper portions these levees consist generally of firm materials, such as the gold-bearing diluvium covered with loam, but frequently interrupted by banks of mud, containing beds of leaves, and branches of trees. Below Noanamá we saw no more of this auriferous deposit, except in occasional bluffs.

As we descend, the levees gradually become lower, and consist of softer materials, until at last they merge into soft swamp mud, overflowed at high tide by the Pacific.

Generally speaking, trees fit for fuel are rare along the banks. Bamboos and several varieties of palms occur throughout. We observed no grammalote grass above the San Augustín; but below that stream it gradually becomes quite abundant.

The map does not exhibit all the low hills we saw, some (especially between the Cucuruppí and Munguidó,) having been accidentally omitted. In some few instances, these, instead of an unbroken range, consist of lines of isolated cones. All were covered with trees and shrubs, except where slides had taken place. In such cases the only materials distinguishable were the gray rock, so often alluded to, in various stages of induration; and gravel, and clay. None of the hills appeared to exceed about 300 feet in height; and generally, were below that limit.

Having thus briefly referred to the general characters of the San Juan, we will proceed to notice a few of its details.

We did not ascend the river above San Pablo, but were told that its navigation became much more impeded by rapids and shoals; a fact which, however, was quite inferable from the contiguity of the mountains in which it has its rise. We commenced our descent of the river in August 27, at half past 10 A. M. The velocity, even at its present low stage, is at least as great as that of the Atrato above Quibdó, when in high flood; and we paddled off at the rate of about four and a half miles per hour with ease.

I have stated that at both visits to San Pablo, we happened to find the river at the same stage, viz. five feet deep for nearly its entire width of 450 feet; and that its ordinary stages here fluctuate between five, and seven or eight feet.

But while the depth was five feet at San Pablo, we found a few places within four miles below the town, that gave but four feet as the greatest depth for a very narrow part of the channel; the greater portion of the cross-section at those points affording but three, or three and a half feet. In such places the river can scarcely have sufficient depth for the larger canoes or ranchadas of the country, in its lowest stages.

At a few hundred yards below the town is a bad shoal of large rounded pebbles, which (when there is five feet channel at the town) has but eighteen inches of water, with the exception of a width of about seventy feet on one side; where the water impinging strongly against a rocky hill bank on the concave side of a considerable bend, has worn for itself a channel of from twelve to sixteen feet in depth. In ascending the rapid at this spot, our men could not pretend to stem the current in the deep

part, and had to get into the water in order to force our ranchada up even the shoal portion.

We found this rock to be an excessively hard and tough tertiary sandstone, containing pebbles. We saw in it a few very thin seams of black bituminous matter, resembling some bituminous coal, or compact lignite. The strike of its strata was about N N W. and S S E., with a nearly vertical dip. We observed no fragments of shells in it. This rock shows itself at different points for a few miles below San Pablo, and supports the auriferous diluvium. Its strike and dip both appeared to vary in different places, as well as we could judge from the small portions exposed.

About a mile below the town occurs another shoal, over which the river runs very rapidly. To the eye, the fall here appears to be about three feet in 100 yards.

A little below this shoal, we found six feet of water nearly all the way across; but at half a mile below that again, there were but from three to four feet; or less than at the town.

Between San Pablo and the Surúcco, the San Juan appears to be a succession of dams and pools. In this distance of some seven or eight miles, there occur five bad shoals and rapids. But below the Surúcco, there are none of any importance, except a rapid about half a league below the Mico. This, however, is less formidable than the others.

At ten miles below San Pablo, in a straight reach, where the river was nearly 600 feet wide, we found a depth of six feet for a width of 100 yards. This becomes reduced to about three feet in the lowest stages.

At this place, as well as at others, both above and below it, we plainly heard a low tinkling sound, which at first, we thought was produced by a few large shower drops falling on the dry leaves of our toldo cover. Our men, however, said it was to be heard at all times, being caused by the rolling of the pebbles on the bottom of the river; and, by placing our ears near the water, we heard it much more plainly. It is difficult, however, to reconcile the rolling of large pebbles, and a surface velocity in the river of but three miles an hour; and I certainly have never known the same effect to be produced in any other stream. A little above Noanamá, the sound was quite distinctly, and uninterruptedly audible, where the depth was nine feet.

From the Tamaná, (or about four leagues below San Pablo,) down to the ocean, we felt at times a brisk, refreshing breeze setting up the river, which we were told was the sea breeze.

This branch of the San Juan appeared to be about seventy-five yards wide at its mouth. The broad marsh tracts which border it, afford views of the mountains of Nóvita, from the San Juan.

For several leagues below the Tamaná the river has many bars, which were bare when we desended, and which at a somewhat higher stage of water, would require a skilful pilot. We also noticed many large sunken trees which would embarrass the navigation in low stages.

Having descended the river about nine leagues below San Pablo, we stopped a little before sunset, at a negro hut a mile above the Dipurdú. Here we bought some chickens for supper, but our men could procure

nothing to eat with them. The Doctor and I had our biscuit and claret; but our peones had declined laying in a supply of plantains at San Pablo, on account of their exorbitant price of a dollar and a quarter per ration of sixty-four. This fruit is the principal article of food of the lower classes, and I really pitied our poor fellows, who had expected to be able to procure them at any hut along the river. We had not eaten during the day, having postponed doing so from time to time, in hopes that at the next hut we should be more fortunate.

Arrangements with peones should always require them to find themselves in provisions. Otherwise they are continually discontented; and moreover, are apt to eat so much as to incapacitate them for hard work. I have, on previous occasions, before the adoption of this rule, had three or four naked peones rolling themselves in the sand in agonies of colic induced by stuffing, rubbing their stomachs, and crying out in piteous tones, "mi madre, mi madre" (my mother, my mother). At first I relieved them by doses of brandy; but as this course increased the number of attacks to an alarming extent, I abandoned it, and made them instead, an allowance in money sufficient for abundant supplies. After this I had no more cases of colic among my men.

While supping, we had trouble to keep the roaches, and the noses of a dozen half starved dogs out of our plates. Some six or eight naked negroes stood by, anxiously watching every mouthful, with expressions of astonishment that we did not hurt ourselves with our knives and forks: for in this section of country, the adage, "fingers were made before forks," still applies in full force, except among a few families in the large towns.

During the afternoon we had two or three smart showers; but at dusk it began to rain hard, and so continued until midnight. The river however, fell nearly a foot.

The next morning we started at sunrise, a thin mist hanging over the river, and adjacent marshes. The current was still full three miles per hour, so that with but one peone paddling at a time, and that very lazily, we made four and a half miles.

At a mile below our starting place, we passed the mouth of the Dipurdú, which here appeared to be a mere creek, some fifty feet wide, and full of old logs. At its head is an atravesia communicating with the Sandó, a branch of the Pepé.

A mile below the Dipurdú, in a straight reach of uniform cross-section, and where the width of the San Juan was at about its average of 200 yards, we found a mid-channel depth of nine feet for full half the width. Judging from the line of no vegetation along the sides of the levees, I consider this as what may be called a *low ordinary* stage, but which is doubtless frequently reduced to some six feet.

At about nine miles, (or thirty-six miles below San Pablo,) we passed the river Sipí, or San Augustín, the largest tributary of the San Juan.

About 12 miles below the San Augustín, or 48 miles below San Pablo, we passed the village of Noanamá, opposite which I stopped the rancha-da for a few minutes in order to make the sketch Plate v.

Here the San Juan is about 250 yards wide; and the current was full three miles per hour, notwithstanding the moderate stage of the river.

Owing to the accession of the waters of the San Augustín, we here

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found the depth on the convex side of a bend at Noanamá to be thirteen feet for half the width of the stream, thence gradually increasing to 27 feet near the concave side.

Part of the banks for several leagues above, as well as close to the town, consisted of the indurated tertiary grey clay, with small fragments of shells. At Noanamá the strike of its strata was N E., with a dip of some 15 or 20 degrees to the S E. In other places we found different dips to this same formation, ranging from horizontal to vertical; but the strike generally appeared to be N. Eastwardly.

As we paddled past Noanamá, our poor peones hailed every one they saw on the banks, (as they had done all the way down,) to inquire for plantains, or anything else that a poor half starved mortal could eat. But nothing was to be had.

About sunset we again stopped for the day at a miserable negro hut, some 13 miles below Noanamá, or 61 miles below San Pablo. Unfortunately for our hungry peones, the destitution of comestibles was here greater than at any of the numerous huts at which we had unsuccessfully applied during the day.

In vain did I suggest to the patron, the expediency of resorting to a neat little "ruse," which I had before known to be eminently successful in similar emergencies, viz: to walk around the premises, and by the most singular accident conceivable, to cut off the heads of two or three chickens by a single stroke of a machete aimed at an imaginary snake rustling in the adjacent bushes. He assured me, with a doleful face, that a most thorough reconnoissance had failed in detecting a single chicken track near the house.

I then appealed to his best sympathies by uttering the single word, "platanos," (plantains.) He replied by the single word, "tampoco," (neither.)

To my "nada?" (nothing?) he despondingly sighed, "nada!"

Finally, I suggested the pleas of hospitality, religion, the Governor's letter, and, last of all, the respect due to the patron's own official position as a Judge, or Justice of the Peace, (which he actually held.) The Judge stood up to the suggestion like a man, and poured in a volley of hospitality, religion, letters, and respect for the laws, that might have melted the heart of a stone. But our hostess did not happen to be a stone; but merely the stump of a segar, attached to something resembling the outlines of a mummyfied orang outang. While the Judge feelingly quoted the injunction to "feed the hungry," and expiated upon the fine opportunity that now presented itself, for a practical application thereof, the segar complacently persisted in evolving the most contemptuous volumes of smoke imaginable; while the aperture in which it was inserted, automatically marked the termination of each tender appeal, by a grunt of "no hay nada," (there is nothing.)

And, in fact, there was nothing; so the Doctor and myself were compelled to provide for the whole party from our own scanty supplies.

The only rain that fell to-day was a few drops early in the morning, and a thunder shower of half an hour's duration in the evening. The river fell two feet in the course of the night.

Next morning we gladly left this inhospitable spot an hour before sun-

rise, and proceeded on our way, hailing every hut we passed in hopes of finding provisions. On these occasions, the colloquy between the patron and the people on the banks, was usually in this style:

	Spanish.	English.
Patron.	Adios Amigos.	How do you do, friends?
Dogs.	Bow, wow, wow.	The same.
Hut.	Adios señores.	How do you do, gentlemen.
Patron.	Hay platanos?	Have you plantains?
Hut.	No hay.	We have none.
Patron.	Una gallina?	A hen?
Hut.	Tampoco.	Neither.
Patron.	Huevos?	Eggs?
Hut.	Tampoco.	Neither.
Patron.	Caña?	Sugar-cane?
Hut.	Tampoco.	Neither.
Patron.	No hay nada?	Have you nothing?
Hut.	Nada absolutamente.	Absolutely nothing.
Patron.	Valga me Dios. Adios Amigos.	God help me. Good bye, friends.
Hut.	Adios Señores. Que vayan, ustedes con felicidad.	Good bye, gentlemen; may you go with happiness.
Dogs.	Bow, wow, wow.	

Fortune, however, smiled on us at last, and at an Indian rancho we purchased chickens, eggs, and plantains, sufficient for all hands; beside shooting a wild turkey. At another Indian hut, about 24 miles below Noanamá, we stopped to cook our breakfasts. The proprietor was a grave, and very respectable looking old man, somewhat sleek and rotund; and altogether decidedly civilized and aldermanic in his general appearance, which presented a striking contrast with the usual semi-barbarous aspect of his countrymen. He had been indulging rather too freely in guarápo the night before; and was still asleep when we entered, although it was 10 o'clock. Unaldermanlike, however, he was on top of a table, instead of under it.

A handsome silver-headed cane reposed by his side; and about a dozen massive silver rings graced each ear. From this, I inferred that he was a kind of chief, or *ring-leader* of a tribe. At last he awoke, and sat up on the table in a state of semi-consciousness, while his wife washed his face, and swabbed him down with a rag.

Revived by this operation, he began to look stupidly around him; and I at once apologized for having ventured to intrude upon his domain without permission. He smiled good naturedly, and merely replied in a bland tone "the old man is your servant."

We generally found the Indians to be taciturn, as regards putting questions to us, although they invariably replied to ours with entire readiness, and in a kind friendly tone. They also appeared to be as devoid of curiosity as our own Indians; and never annoyed us in the least degree by intrusiveness of any kind.

They speak both Spanish, and their own peculiar idioms; but the Negroes speak Spanish only.

At, and below Noanamá we passed many painted, and a few tattooed Indians. Some of the latter were perfectly diabolical looking objects; and our sense of propriety was at times severely tested in refraining from laughter at their comico-lugubrious phizes.

Along here, the sand-fly gnats began to be troublesome on shore, which is becoming lower and more entirely swampy, except where broken by hills.

The rivers Cucuruppí and Copóma, which we passed to-day, appeared to be each about 100 feet wide at their mouths. The Guapágara seemed to be but a small creek; as did also the Decordó,* the Jusia..ó, and the Panamá. The Munguidó has a width of perhaps 200 feet at its mouth, and looked like a fine stream. At half a league below the Munguidó, commences an island half a league in length; which, by a slight oversight, is incorrectly shown on the map. At its lower end we found a negro rancho, at which we stopped at sunset, having descended the river about 90 miles below San Pablo, or 42 miles below Noanamá.

Miscalculating the length of our trip from Acosta's map, we had expected to reach the Pacific to-night; but we were here told that a full day's voyage yet remained to be performed.

At this point we found the current to be about $2\frac{1}{3}$ miles per hour. The island was some 6 or 7 feet above the surface of the river; but our host, who has lived on it for a quarter of a century, told us that the San Juan sometimes rises here as much as 10 feet above the stage in which we saw it, submerging the island, the levees, and a very wide tract of back country on both sides.

We noticed many bats flying about the house, and clinging to its ceiling; and were much annoyed by gnats.

There was rain for about an hour in the middle of the night.

When we started next morning, our host accompanied us. We were pretty certain that we should not reach the ocean until after dark; and as the river has several mouths, and our peones had never been here before, there was a reasonable chance of losing our way, unless provided with a guide. I therefore proposed to the master of the house, that he should go with us in that capacity; and he good naturedly consented.

A set of soundings taken about four miles above the confluence of the Calíma, at a place where the width of the San Juan was some three hundred yards, gave but three feet of water, extending from one bank to near the centre of the stream. The other half of the width, however, varied from 20 feet deep near the sides, to 45 feet in the centre. Our new pilot told us that the river did not fall sufficiently low to expose the shallow portion of the bed, more than three or four times a year. The clay and mud levees about here, were generally from three to five feet above the ordinary stage of water as we now saw it.

The River Calíma enters the San Juan about nine leagues above Chirambirá.

When we returned from the Ocean, we ascended it several miles on our way to Buéna Ventúra, and I will refer to it more fully in the proper place.

At four leagues below the Calíma, or five leagues above Chirambirá, we reached the point at which the San Juan bifurcates into the two chan-

* The terminating "do," means river, in the Indian dialect. Quibdó, is the river of gravel; Murindó, the river of mud; Munguidó, the river of mosquitoes, &c., as given to me by Lieutenant Porras of Quibdo.

nels which constitute the northern and southern boundaries of the delta at its mouths.

The principal volume of water flows through the southern branch, which still retains the name of San Juan. Its width appeared to be about the same as for some miles above the point of divergence, namely, near 300 yards; with a mid-channel depth of between six and seven fathoms. This branch, however, is not used, on account of the formidable obstructions of bars at its mouth.

The northern branch is called the Caño Chirambirá; and has, at its junction with the southern one, a width of but 150 yards; with a mid-channel depth of three fathoms.

Before reaching the Ocean, this caño separates into other branches, which discharge into the Pacific, through their respective mouths, as shown on the Map. Plate VIII.

At about two leagues from the Ocean, Caño Estevaníco diverges to the south; and at one league, Caño Chogoromá passes off to the north. At the last point, Caño Chirambirá has gradually attained a width of some 200 yards; but its channel-depth has diminished to ten feet at ordinary low tide of the Pacific. At half a league from the sea, Caño Chirambirá turns to the southward, and enters (in a distance of a few hundred yards) the head of the insignificant bay of the same name; while Caño Churimál, forms the straight continuation of the principal body of the water. See Map, Plate VIII.

This branch widens rapidly as it approaches the sea.

Both Caño Chirambirá and Caño Estevaníco, are nearly dry at low water, near their respective entrances into the bay.

It is, indeed, only by a stretch of geographical courtesy, that this sheet of water can be called a bay. At extreme low water, more than three-fourths of its area are dry. It is, moreover, rapidly filling up with mud brought into it by Caños Chirambirá and Estevaníco; as well as that from the circumjacent mangrove swamps. Señor Carcáche, the proprietor of Chirambirá, has resided in this purgatory for twenty-two years; and he informed me that he has seen large ships float at anchor at low water, in portions where they would now ground at the highest tides. At that time there existed, according to his statement, an ample depth of water over the bar, for the entrance of merchant ships; while the bay itself, constituted a safe and capacious harbor of refuge, to which vessels frequently resorted in stress of weather. He assured us, moreover, that a good entrance channel, with some four or five fathoms of water, still remains. Of this, however, we perceived no indication from any point to which we could venture out in our boat, after having taken the precaution to convert her into a "bolsa," by lashing stout poles to her sides, to prevent upsetting.

On the contrary, the whole coast, as far as we could see, for several miles above and below the bay, appeared to be defended by continuous parallel lines of bars and breakers.

The sketch (Plate VIII,) which I have given of the bay, is an extremely rude one, based merely upon rough estimates of distances by eye, aided by compass bearings, taken from a canoe as it was being paddled around close to the shore at high water. The soundings were made near the

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time of *ordinary* low water, and are tolerably approximate for that stage. A reference to the sketch will show that a small part of the bay has a sufficient depth to render it available as a harbor of refuge, in case there should really be an entrance to it across the outer bar. On this point I am not prepared to give a definite opinion; for, on the one hand, I am unwilling to assume that Señor Carcáche's long residence at Chirambirá had rendered him indifferent to the doctrine of future punishment; while, on the other, I could see no interruption in the long lines of outside breakers sufficient to warrant the suspicion that he was correct. We did our best to determine the point by actual sounding; but were driven back by the roughness of the sea. We could procure no vessel larger than our small ranchada; and, in view of the hopelessness of an inter-oceanic canal, as established by my examinations in the San Pablo region, I did not consider it worth while either to incur any serious risk, or to remain at Chirambirá for a perfectly calm day.

Chirambirá consists only of the dwelling of Señor Carcáche, and a few wretched out-huts, without sides, for his dependants; (see Plate VII.) It occupies a short narrow strip of low sand beach, the only habitable spot around the bay. All the adjacent country is mangrove swamp, overflowed by high tides. Indeed, the buildings themselves are occasionally insulated by extreme high water; so that it would be difficult to imagine a more ineligible spot for a habitation.

Had it not been for the precaution of taking a pilot, we should certainly have dropped down Caño Churimál, and gone to sea; for the night was perfectly dark for some time before we reached the point at which Caño Chirambirá diverges at right angles from the larger Churimál branch; and as the rain was at the same time pouring in torrents, we could not see the proper course. Our pilot, however, found it by some instinctive faculty; and very soon the tossing of our boat proved that we were near the ocean. After half an hour's uncomfortable expectation of being upset in the dark, we at last landed at the only spot where landing was possible, in front of the huts. All the occupants had retired for the night; but our pilot "knew the ropes," and guided us to the largest one. Of a portion of this we took possession, and were soon asleep on the hard floor, supperless, and unmindful of the trickling streams that fell on us from the holes in the roof.

Our observations at Chirambirá, which are embodied in the Map, Plate VIII, occupied us for two days; and early on the morning of Thursday, September 2d, we left it for Buéna Ventúra, via the San Juan and the Calíma.

I had remained well during the entire trip, until, singularly enough, while in the act of drawing in my lead line, after taking the last sounding in the bay, I was attacked by a severe chill. The reflection, however, that I had fully accomplished the object of my mission, served to alleviate what would otherwise have proved a very harassing incident; and, as I stretched myself out on the palm strip floor, during the subsequent paroxysm of fever, it was with the independent feelings of one who could now afford to be sick.

It rained every day and night while we were at Chirambirá; not continuously, but in a succession of hard showers during the day, and pretty

steadily throughout the night. As we ascended the San Juan on our return, I had an opportunity of supplying some compass-bearings and distances, which the darkness of the night had prevented me from obtaining as we descended.

Traveling against the current, we gained but 20 miles the first day, although we kept on until after dark. We should have done better had we not stopped for half an hour to enable our pilot to pay a flying visit to a friend living on the bank. Two of our peones accepted a pressing invitation to accompany him; the consequence was, that they all imbibed so much guarápo as to prevent the pilot from returning at all; while the peones, for the remainder of the day, were continually "catching crabs" with their paddles; and turning summersets, sometimes into the boat, and sometimes into the water, from which we had to fish them out.

The hut at which we passed the night, consisted of but one room; and was occupied by five families. They did not, however, lie about the floor promiscuously; but each family, on retiring, spread for itself a separate *tent*, each about five feet long, and three and a half feet high. Delicacy forbade my lifting the side of a tent, to see how they packed themselves away, but from their numbers it must have been much in the cozy style of boxed herring.

It rained heavily during the night until daybreak.

At 9 o'clock next morning, we reached the mouth of the Calíma, and commenced the ascent of that stream.

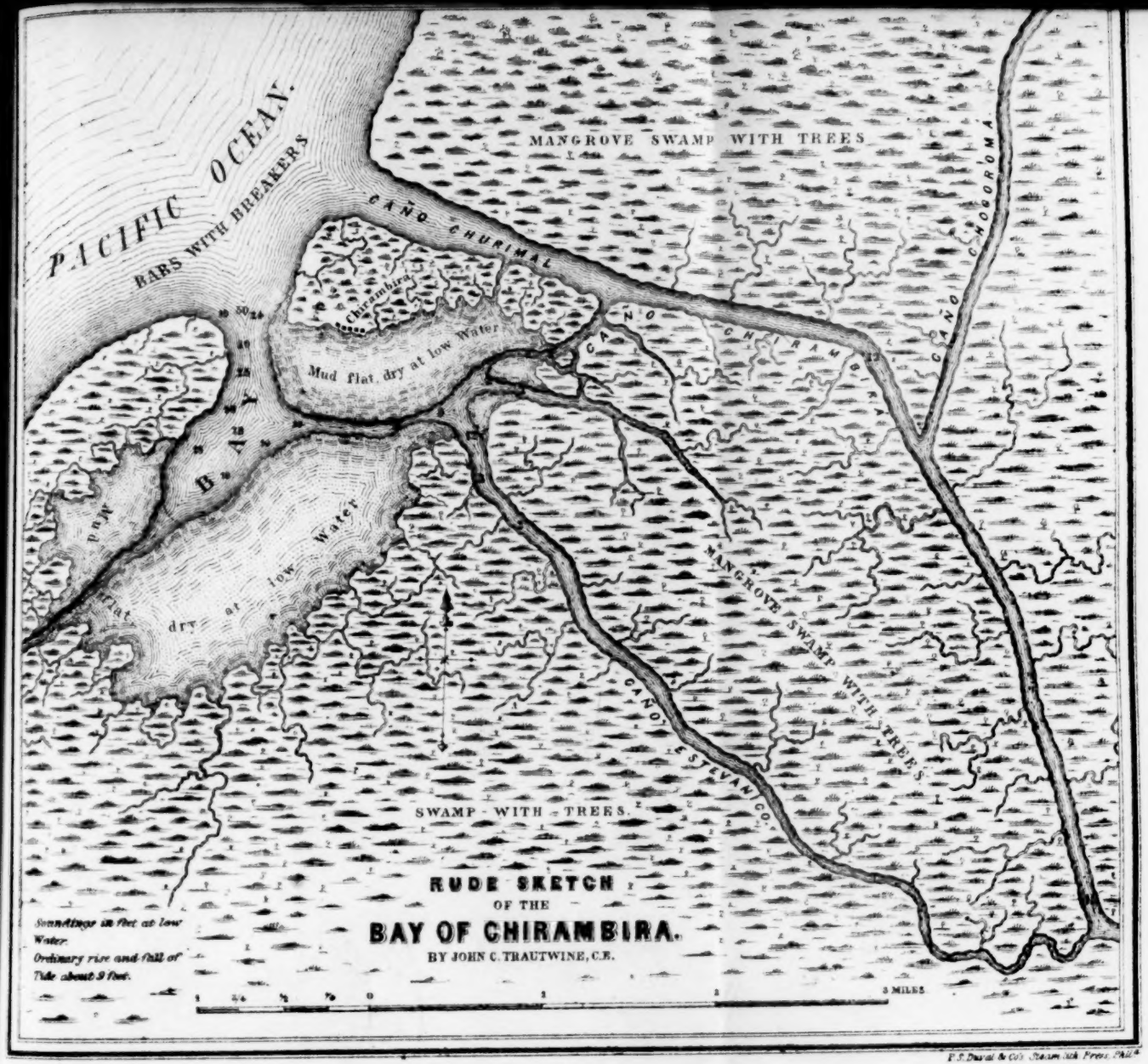
I had been quite unwell all the preceding day, and still continued so. It was only by extremely unpleasant exertion that I could continue, and note down the few very superficial observations that I made respecting the Calíma, and the remainder of our route to Buéna Ventúra.

This branch of the San Juan enters the latter at about 9 leagues from the Pacific. Its width at its mouth is above 200 feet; and this width it preserves for four or five miles, with a mid-channel depth of full 12 feet at ordinary stages. At 10 or 12 miles from its mouth, it has an ordinary mid-channel depth of 10 feet; and a width generally varying from 125 to 175 feet. Its levee-banks, as far as we ascended it, were clay and mud, containing beds of old leaves and branches of trees. Back of them the ground was swampy. Gravel shows itself in a bluff near the mouth, and also some ten miles above it; and throughout, low bluffs from 15 to 20 feet high occur. We saw no nearer approximation to rock than the indurated gray clay occasionally.

At 5 o'clock P. M., we stopped for the day, nearly 6 leagues from the San Juan. From here upwards, gravel becomes more abundant, both in the bed of the stream and in the banks. No rain to-day or to-night!!

At about seven leagues from the San Juan, we left the main Calíma and entered one of its branches, called the Guinéo. Up to this point the Calíma was rarely under 40 yards wide.

We followed the Guinéo but about a mile, and then entered a branch coming from the S W. This latter is a trifling stream, averaging from 6 to 8 yards wide: very serpentine, and with but from one to two feet of water when we ascended it. Its very bed is generally between five and eight feet below the tops of the banks; and is full of old fallen trees, and logs. The banks themselves consist of clay, mud and layers of old



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leaves. At a few spots we saw the indurated gray clay, disposed in nearly horizontal strata, and occasionally containing so much coarse sand and gravel, as to constitute a species of soft sandstone. This little branch we ascended for some eight miles to the place of debarkation.

Here we left our boat, and walked across a pathway about one and a half miles long, to the stream which was again to carry us to the Pacific, at Buéna Ventúra.

Before leaving Chirambirá, I had communicated to the patron and peones, my intention not to return to San Pablo and Quibdó; but had secured their services to accompany us across the atravesía, at which we had now arrived. Here they strapped to their foreheads the little baggage which Doctor Halsted and myself had brought with us, and started off for the Puérto de Guinéo, half a league distant.

At my request, the Doctor accompanied them, in order, if possible, to secure either a canoe for proceeding at once to Buéna Ventúra; or a place in which to lodge for the night. Being myself excessively weak from fever, I did not wish to impede our progress. The walk of a mile and a half occupied me two full hours. The pathway is across an elevation which I judged to be less than 100 feet above the stream we had just left; and still less above that to which we were going. The soil is clay, resting on the indurated tertiary gray clay. I saw no fragments of shells in the latter, at this place.

When I reached the other end of the atravesía, I found that in consequence of the approach of rain, Dr. Halsted had not been able to induce the boatmen of the Puerto to take us to Buéna Ventúra, (distant 4 hours,) that evening; but he had secured a very good lodging place in one of the half dozen huts which constitute Puerto de Guinéo.

Next morning at 6 o'clock, we bade farewell to our faithful patron Rociles, and his peones; and entering a canoe we reached Buéna Ventúra at 10 A. M.

This is a mean hole, about as large as Quibdó, consisting chiefly of one main street, and containing about a hundred huts, and tumble-down frame houses, many of them two stories high. It stands on one side of the little bay of the same name, between which and it there is no parallel thoroughfare; but, at low water, a wide mud-flat. The town itself stands on dry land; and there is a slight hill of the gold-bearing diluvium in its rear. All else is marsh. The visiter who ascends the hill, will be rewarded by a birds'-eye view of the town, and the bites of a thousand yávis, or minute seed ticks.

After a delay of five days, we took passage in a little coaster, (a cross between a tub and a sieve,) for Panama, where we arrived safely in a few days.

Note.—Owing to the inexcusable negligence of the person intrusted with the preparation of the Map, Plate XII, Volume XXVII, the coloring of my line of routes was omitted.

*On Compound or Trussed Cast Iron Beams or Girders.** By W. Fairbairn, C. E., F. R. S., &c., &c.†

(Continued from page 229.)

This result is consistent with that of Table I., where the elongation of cast iron, for equal increments of force, is shown to be $2\frac{1}{4}$ times that of wrought iron. The elongations in this table may be approximately derived from Table I.

Further, with a force of about $5\frac{1}{2}$ tons applied to cast iron, and $12\frac{1}{2}$ tons to wrought iron, the sets, as well as the elongations, are nearly equal to each other. Now, if these forces had been duly apportioned to each other, this circumstance would have given us an eligible principle for adjusting the tension of the iron rods in a truss beam; but, unfortunately, this strain upon the cast iron is too near the strain requisite for producing rupture, while that upon the wrought iron is only about one-half its greatest tensile resistance. For forces below $5\frac{1}{2}$ and $12\frac{1}{2}$ tons, the set of the cast iron is greater than that of the wrought iron; and for forces above $5\frac{1}{2}$ and $12\frac{1}{2}$ tons, the reverse takes place.

Table IV.—*Ultimate elongations, the cast iron being loaded with 7½ tons per square inch, and wrought iron with 24 tons per square inch.*

Name of the Metal.	Total ultimate elongation, in parts, of the length of the bar.	Ultimate elongation per ton, in parts, of the length of the bar.
Cast iron, . .	$\frac{1}{455}$ or ·22 in. on 10 feet.	$\frac{1}{4060}$
Wrought iron, .	$\frac{1}{21}$ or 5·7 in. "	$\frac{1}{3520}$

Hence it follows that the ultimate elongation of wrought iron per ton on each square inch is about eight times that of cast iron, and that the total ultimate elongation of wrought iron is about 26 times that of cast iron.

If we take the results of Mr. Loyd's experiments,‡ where the average of the breaking weights was 32 tons per square inch, we shall find that the total ultimate elongation of wrought iron is about 130 times that of cast iron.

Table V.—*Permanent set of bars, expressed in parts of their elongation.*

Weights in tons per square inch.	Cast iron. Set in parts of the elongation.	Wrought iron. Set in parts of the elongation.
2	1-13	} Scarcely per-
3	1-11	} ceptible.
5	1-9	1-110
7	1-7	1-112
10		1-60
15		$\frac{1}{12}$
20		11-12

* "*On the Application of Cast and Wrought Iron to Building Purposes.*" By W. Fairbairn, C. E., F. R. S., &c., &c. London: J. Weale. 1854.

† From the London Artizan, June, 1854.

‡ See the Author's *Experimental Inquiry into the Strength of Wrought Iron Plates, &c.*, published in the Transactions of the Royal Society for 1850.

Here it will be seen that for weights below $7\frac{1}{2}$ tons, the set of cast iron is incomparably greater than that of wrought iron; on the contrary, for weights above 15 tons, the set of wrought iron is considerably greater than the maximum set of cast iron.

TABLE VI.—*Mean elongation of cast iron and wrought iron bars* 10 *feet long, by an increase of* 90° *temperature.*

Length of bar 10 feet.	Elongation due to 90° increase of heat.	Difference of the elongations on 10 feet.
Cast iron, . .	·0666 inches.	·0067 inches.
Wrought iron, .	·0733 "	

Comparing the results of this table with those of Table I, we find that the elongation of wrought iron by an increase of 90° temperature is equivalent to the action of a tensile force of 7·4 tons per square inch, and that of cast iron to a force of 3 tons per square inch. Moreover, the difference of the elongations of the two metals is equivalent to the action of a tensile force of $\frac{3}{4}$ ton per square inch. It is also worthy of remark, that while making experiments relative to the elongations of metals when acted upon by tensile forces, we should carefully observe that the temperature remains nearly the same.

From a careful induction of the facts contained in these tables, let us endeavor to determine the best adjustment of the tension of the truss rods.

First—Let us consider the case, when the truss rods have no strain upon them at the time the beam is unloaded.

Suppose the beam to be loaded so as to produce a tensile strain upon the cast iron equal to one-third its breaking load, that is to say, let the force of elongation be $2\frac{1}{2}$ tons per square inch upon the cast metal; then, from Table III, we find that the strain upon the truss rods will be about $5\frac{1}{2}$ tons per square inch, and that the set of the cast iron, after these strains are taken off, will be six times that of the wrought iron. Now, in this case, while the cast iron is strained to one-third its breaking weight, the wrought iron is strained to only about one-fifth its ultimate strength; and, further, when the load is taken off, the cast iron beam will remain much more elongated than the iron rods, which will, to a certain extent, destroy their original adjustment of tension; but this, in the present case, will not act unfavorably, for it will tend to give a certain amount of tension to the truss rods.*

Suppose the beam to be loaded so as to produce a tensile strain upon the cast iron equal to $5\frac{1}{2}$ tons per square inch; then, in order to produce an equal elongation of the truss rods, the strain upon them must be $2\frac{1}{4}$ times $5\frac{1}{2}$ tons, or $12\frac{1}{2}$ tons nearly. Here, while the cast iron is strained to more than two-thirds its ultimate resistance, the wrought iron is only strained to about one-half its ultimate resistance. One favorable circumstance connected with this load is, that the sets of the two metals are very nearly the same.

Suppose the beam to be loaded so as to produce a tensile strain of 15 tons per square inch upon the truss rods, then, by Table II, this will pro-

* We have here considered the length of each truss rod to be one-half the length of the beam. This supposition will obviously involve no appreciable amount of error.

duce an elongation of $\frac{1}{4\,1\,0}$th part of the length of the rod; but by Table IV, the ultimate elongation of cast iron is $\frac{1}{5\,5\,0}$th part of its length; therefore, the cast iron would be ruptured by extension some time before the truss rods could arrive at a strain of 15 tons per square inch, that is, before they could be strained to two-thirds their ultimate strength.

This adjustment is defective; the truss rods must obviously have a certain amount of tension before the load is laid on, in order to bring them into a higher condition of action, and to counteract the set of the cast metal.

Second—Suppose the truss rods to be screwed up so as to give them a tension of 8 tons per square inch, or one-third their breaking tension; and, for the sake of simplicity, let us suppose that the half length of the beam is 10 feet. This high tension of the truss rods, it should be observed, will produce a dangerous action upon the cast metal.

Suppose the beam to be loaded so as to produce a tensile strain of $7\frac{1}{2}$ tons per square inch upon the cast metal. Now, by Table IV, this would give an elongation of ·22 inches; but the truss had an elongation of ·077 inches due to the strain of 8 tons when the beam was in a neutral condition; therefore, the total elongation of the truss rod will be ·22+·077, or ·297 inches; but from Table II, we find this elongation to correspond to about 16 tons per square inch tensile force upon the rods. Thus it appears that, even with the dangerous tension of 8 tons per square inch on the truss rods, we cannot produce a higher strain than 16 tons upon them at the moment when the cast iron is about to rupture.

Reasoning in this manner, it may be shown that it is impossible to construct a truss beam which shall task the high tensile resistance of wrought iron without at the same time introducing a dangerous action upon the cast metal. We have shown, in Tables II and IV, that for high proportional tensions, the rate of elongation of wrought iron is from 10 to 26 times that of cast iron; hence it is impossible to have the two metals acting in concert at tensions approaching their rupture.

Since little is gained by this high tension in point of ultimate strength, and much is lost by the injury done to the beam, we must reduce this tension in order to arrive at the best form of the truss beam.

Third—Let us endeavor to discover the tension which must be given to the truss rods, so that the different parts of the truss beam may be respectively loaded, at the same moment, with one-third their respective ultimate tensile resistances, viz: $2\frac{1}{2}$ tons per square inch for the cast iron, and 8 tons per square inch for the wrought iron.

Here, by the law of Table III, the additional force tending to elongate the iron rods per square inch $= 2\frac{1}{4} + 2\frac{1}{2} = 5\frac{5}{8}$ tons. Putting $t =$ the tension of the rods per square inch at the moment when the cast metal has no strain upon it, we have

$$t + 5\tfrac{5}{8} = 8,$$

$$\therefore t = 2\tfrac{3}{8} \text{ tons per square inch, or } 2\tfrac{1}{2} \text{ tons nearly.}$$

Suppose the beam to be loaded so as to produce a tensile strain of 4 tons per square inch of the cast metal, then the truss rods will undergo an additional strain of $2\frac{1}{4}$ times 4 tons, or 9 tons per sq. in., which, added to $2\frac{1}{2}$ tons, will give $11\frac{1}{2}$ tons for the whole strain per square inch of the truss rods; so that the two materials will be loaded to about one-half their

respective breaking weights; and, moreover, it may be shown from Table III, that the sets of the two metals after the load is taken off will be nearly the same.

Hence it appears that the most eligible adjustment of the truss rods is to give them a tension of from 2 to 3 tons per square inch.

But a load of $5\frac{1}{2}$ tons per square inch on the cast metal would tend to destroy the adjustment; for this would produce a strain of about $13\frac{1}{2}$ tons per square inch on the truss rods; and after the load is taken off, the set of the wrought iron would be about three times that of the cast metal. It may be further observed, that a strain of less than 15 tons per square inch upon the wrought iron would rupture the cast metal.

An ordinary beam (especially when the material is wrought iron) may be safely loaded, to meet contingencies or particular exigencies, within two-thirds of its breaking load; but this cannot be done with truss beams; for, with the best adjustment of the trusses, as we have shown, the cast metal will be upon the point of rupture before the wrought iron has attained two-thirds its ultimate resistance.

Upon the whole, it appears to be impracticable to attain such an adjustment of the parts of a truss beam as to secure the safety of the beam, with a due regard to the most efficient action of all its parts. The two materials are so different in their physical as well as in their mechanical properties, that it seems impossible to construct a beam with them where they can, under all ordinary strains, act in concert with each other. But even supposing that we are able to construct a truss beam with all its parts perfectly adjusted, how long would it remain so? Besides the disturbances arising from unequal elongations and sets, sudden collisions, changes of temperature, and other causes, would tend to destroy this adjustment. The defect of a truss beam consists not so much, perhaps, in its want of economy, as regards the distribution of material, as in its want of stability and safety; within comparatively small limits of load, a truss beam may pass from a condition of perfect security and safety to one of uncertainty and danger.

Approximate Rule for calculating the strength of a Truss Beam.—In order to calculate the strength of trussed beams, let us suppose that the tension of the rods is such as to cause them to have a strain of 8 tons per square inch, at the same moment that the cast iron has a strain of $2\frac{1}{2}$ tons per square inch; then, with this *perfect adjustment*, we have found, by a process of reasoning which need not be given in this place, the following approximate rule for calculating the weight with which the beam may be safely loaded:—

Add three times the section of the truss rods to the section of the bottom flanch, substitute this sum for the bottom area in the usual formula for calculating the strength of cast iron beams, and one-third this result will give the weight of safety, or one-third the theoretical breaking weight.

Thus, let w = the load of safety, a = the area of the bottom flanch, a_1 = the section of the truss rods, l = the distance between the points of support, and d = the depth of the cast metal beam; then

$$w = \frac{26\,(a + 3\,a_1)\,d}{3\,l} \text{ tons} \quad . \quad . \quad (1).$$

In the first series of experiments, we find $a = 1{\cdot}05$, $a_1 = {\cdot}39$, $d = 4$, $l = 4{\cdot}5 \times 12$,

$$\therefore w = \frac{26\,(1{\cdot}05 + 3 \times {\cdot}39)\,4}{3 \times 4{\cdot}5 \times 12} = 1{\cdot}4 \text{ tons} = 3100 \text{ lbs. nearly.}$$

Now, the breaking load of this beam, as given in Experiment III, Table I, was nearly 9000 lbs., giving one-third of 9000 lbs. = 3000 lbs. for the load of safety. Hence it appears that in this truss beam we had very nearly hit upon a perfect adjustment.

Throughout these calculations, we have assumed that the section of the top flanch of the beam is duly calculated to balance the united tensile forces of the truss rods and the bottom flanch of the beam.

Let us now consider the question of economy as regards these beams.

Comparison of Cost.—In estimating the comparative advantages of different form of beams, we should always consider their ratio of cost for a given amount of strength. In order to apply this method of comparison to the case of trussed beams, let a = the cost of the beam without the trusses, a_1 = the cost of the truss rods, a_2 = the cost of their construction, w = the breaking weight of the beam without the trusses, and W the breaking weight with the trusses; then we have—

Comparative advantage of the trussed beam, that of the beam without the trusses being unity:

$$= \frac{a}{a + a_1 + a_2} \times \frac{W}{w} \quad . \quad . \quad (1).$$

In the case of the beam experimented upon, we have—

$a = 4\frac{1}{2}$ shillings, $a_1 + a_2 = 4$ shillings, $w = 5800$, $W = 7400$; then by formula (1) we have—

Comparative advantage of the trussed beam:

$$= \frac{4\frac{1}{2}}{4\frac{1}{2} + 4} \times \frac{7400}{5800} = \frac{2}{3} \text{ nearly.}$$

That is to say, the advantage of the simple beam, as compared with the trussed beam, is nearly as 1 to $\frac{2}{3}$.

For the Journal of the Franklin Institute.

Description of an Instrument for Rapid Surveying. By Edward W. Serrell, Esq., Civ. Eng.

An article, in the *Journal* for September, headed "New Instrument for Rapid Surveying," suggests the propriety of describing one which I had in 1849.

I am not aware that any thing similar has been used, although the idea was taken from a telescope, described to me by Col. Rumford, three or four years previously.

Col. Hughes, U. S. Top. Eng., then in charge of the surveys for the Panama Railroad, sent me orders to have an accurate survey made of the Chagres river, from my camp, near the Rio Gatun, towards Gorgona; with a request that it might be done as quickly as possible.

I had only one assistant that could be spared from the division, but the old adage was verified, and necessity again proved the mother of invention.

I had a very good Young's transit, and an excellent thirty-inch German pocket telescope, with these an Instrument was *manufactured* in the course of the day, by Mr. T. M. Griffith and myself, in the following manner: We had no regular tools; a brad-awl, made of a wrought iron nail, a pair of pliers, a tack hammer, and an adjusting pin, and screw driver belonging to a level, constituted, I believe, with a pocket-knife, all our available apparatus.

In order to render the telescope rigid in the joints of the tubes, a *reed* about three-eighths of an inch in diameter was lashed firmly along its entire length. The telescope of the transit was then unscrewed from the trunnions, and a piece of hard wood, about two feet in length, substituted for it.

On either end of this beam there were blocks, hollowed transversely to receive the German telescope; they were made adjustable by wooden wedges, that a proper vertical plane might be given to the instrument; all the fastenings of the blocks to the beam, and the telescope to them, were made of *bees-waxed black thread*.

This being done, we had merely exchanged a small telescope for a large one on the transit.

How to fix the cross wires in the glass was the next difficulty; we however, made a very good diaphragm of a piece of *dry sugar cane*, with the pith scraped out, leaving it long enough to slide in the tubes, without changing the direction of its axis, while the focal distance was being regulated. But we had no platinum wire, or fine silk, to form the crosses with, but we *had* a pet monkey, and poor *Mono* was made to contribute his share in the emergency; three of the finest hairs, taken from near the root of his tail, supplied the deficiency, and proved an excellent substitute.

One was placed in the vertical plane, and two were stretched across the middle, about one-eighth the diameter of the field apart; at first, some difficulty was experienced in fastening the hairs to the diaphragm, as the sealing-wax used melted in the sun, and they changed their positions; notches were then substituted, in the end grain of the sugar cane, and answered the purpose.

A base line of a thousand feet was then carefully measured on the beach, and the transit so fitted placed over one end of it. We had in the camp, a fourteen feet pine leveling rod, fitted with a sliding target; to this rod at 0. feet, we secured a permanent view, and the rod being then placed at the opposite end of the base line, wrong end upwards, for convenience, an observation from the transit, was made upon it, and the amount of the visual angle, formed between the two horizontal hairs in the telescope upon the rod, was recorded by sliding the target down, until the upper and lower horizontal hairs cut its centre and the stationary vane.

When the telescope was level, and the rod plumb, the angle thus formed was isosceles, the rod forming the base, and by it a ratio was formed, which in this case, as the base line measured was 1000 feet long,

became a decimal quantity; the observation on the rod was between 7 and 8 feet for 1000.

With the apparatus thus fitted, in little more than twenty-four hours from the receipt of the order to make the survey, I started up the river, with two canoes, two Indians, an assistant, and three days' provisions.

By this plan, the force on the field was not sufficiently reduced to interrupt materially the surveys previously in hand, at least for a few days.

The assistant, having with him his note book, level rod, and ten pickets, with white rags tied to them, and an Indian to paddle his canoe, started ahead, and proceeded up stream as far as he could see the first station, there showed his rod, and put up a picket, an observation being taken from the starting point to the rod, the assistant recorded the reading, and left a bit of paper pinned to the picket with the same written upon it. With the instrument, the magnetic bearing and the angle from one line to another were taken.

Both parties then again entered their boats, the first one pushing on as far as he could see his last picket, and then took another position on shore.

While the rear boat was going from one picket to another, the line was plotted on a drawing board placed across the bows, the topography on either side of the river sketched, and the soundings, which were taken by the *Peloto*, who managed the canoe, recorded as we passed along.

At every ten stations we compared notes and exchanged pickets.

In this manner with an instrument so roughly made, we surveyed, sounded, sketched the topography, and mapped, nearly eighteen miles per day.

The work proved correct upon being connected with the theodolite lines, which were run for the railroad.

I have frequently, since, found situations where this instrument has been used to advantage.

AMERICAN PATENTS.

List of American Patents which issued from Aug. 8th, to Aug. 29th, 1854, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

AUGUST 8.

61. For an *Improved Machine for Making Bricks;* R. D. Bartlett, Bangor, Maine.

Claim.—"I claim making bricks of crude, untempered, and unground clay, by the means herein described, or by any other means substantially equivalent thereto. 2d, The manner of forcing the clay, in the state in which it is dug, through the grating in small quantities at a time, by which means it is freed from the stones which it may contain, and prepared to be acted upon by the plunger. 3d, The method of accurately gauging the quantity of clay in each brick, and of submitting them all to a uniform pressure, by means of the hole in the side of the mould. 4th, The manner of arranging and operating the bulk-head, by which it is enabled to assist simultaneously in the formation of two bricks, one in each mould. 5th, The combination of the bulk-head and the plunger with the lever, the lever having sufficient play upon its fulcrum to enable it to operate in the manner set forth. 6th, I claim making the parts of the mould hollow, and heating them with steam."

62. For an *Improvement in Dumping Wagons;* Wm. S. Babcock, Stonington, Conn.

Claim.—"I claim the arrangement of the cast metal boxes or sockets, with boxes or sockets containing concave wheels, the convex track, grooved track, and hooks. Also, the arrangement of gearing drum, crank, ratchet, chains, &c., all operating in the manner set forth."

63. For an *Improvement in Tubular Bridges;* Eden A. Baldwin, Elmira, N. York.

Claim.—"I claim constructing a bridge by the combination of the longitudinal strips of wood, the transverse iron bands, and the arrangement for tightening the same from the inside by a screw and swivel, with the trestle or frame work for supporting a railroad track, and receiving the strain directly on the bands, whether the track be placed within the bridge or upon its top, and forming the cylindrical or tubular bridge of great strength, durability, and simplicity of construction."

64. For an *Improved Process of Imitating Marble and other Substances;* William Bowney, City of New York.

Claim.—"I claim the manufacture of imitations of marble and other substances, from cements or other materials analogous thereto, by the application of the requisite coloring matter, prepared as described, either to the surface of the cement, or to a polished surface or mould, by means of a syringe, or other analogous instrument."

65. For an *Improvement in Air Heating Stoves;* Nathaniel A. Boynton, City of N. Y.

Claim.—"I claim constructing the entire fire chamber of one single casting or piece."

66. For *Fire Arm;* Isaac W. Brown, West Springfield, Massachusetts.

Claim.—"I claim giving the cylinder a partial rotation by the cocking of the fire arm, and completing the movement necessary to bring the nipples successively under the hammer by the act of discharging the piece."

67. For an *Improvement in Preventing Rattling in Carriages;* William S. Chapman, Cincinnati, Ohio.

Claim.—"I claim the employment of blocks of india rubber, or equivalent elastic material, of the form set forth, between the ends of carriage shafts and the clips upon the axles, for the purposes of preventing wear, rattling, noise, and accident."

68. For an *Improvement in Cotton Presses;* Nathan Chapman, Mystic River, Conn.

Claim.—"I do not claim the toothed wheels with projections thereon, separately; neither do I claim operating the follower by means of chains; but I do claim forming the hubs of the wheels with recesses in them to receive the rods, when said chains are wound up on the projections on the wheels, in the manner described."

69. For *Improvements in Sawing and Planing Machines;* Daniel Close, Hammonsville, Pennsylvania.

Claim.—"I claim the arrangement of one or more saws to cut on the down stroke, in combination with one or more planes to cut on the up stroke of the cranks, whereby the sawing and planing are performed alternately, which tends to equalize the motion of the machine, and make both instruments work more smoothly, so that it takes very little more power to drive both than it would to drive either."

70. For an *Improvement in Rosin Oil Lamps;* Silas Constant, Brooklyn, N. York.

Claim.—"I claim constructing the tubular wick guide without any opening through it, except at or near its lower end, and making said guide of such a size as to allow a clear annular space between it and the wick for the oil to rise in around the wick, for the purpose of preventing the oil inside of the upper portion of said wick guide from mixing with the body of oil outside of the same, by which the oil in contact with the upper portion of the wick will be raised to a considerably higher temperature than the oil in the body of the lamp. Also, the regulating of the flame of the lamp by raising or lowering, in any convenient manner, the inner conical tube, which immediately surrounds the upper end of the wick."

71. For an *Improvement in Stop Motion for Speeders;* Lewis Cutting, Lowell, Mass.

Claim.—"I claim, 1st, The use of the independent hinged lever, rod, or wire, moving in guides for tripping the shipper and throwing off the belt, thus relieving the trumpet from any further duty in throwing off the belt than the mere raising of said lever, rod,

or wire, which makes its operation more certain. Also, in combination with the hinged lever, the interposition between the cam and trumpet of a guide so arranged as to give sufficient friction to the rooving, when it rises irregularly from the cam, to prevent the dropping of the trumpet, and consequent throwing off of the belt."

72. For an *Improvement in Manufacturing Pigments from Iron Ore;* J. H. Davis, Morristown, New Jersey.

Claim.—"I claim the process for making said colored pigments by the steaming of said ores, in addition to the usual process of selecting, pulverizing, and heating the same, for the purpose of obtaining pigments."

73. For *Improvements in Fire Arms;* Joseph C. Day, Hackettstown, New Jersey.

Claim.—"I claim, 1st, Connecting the barrel with the stock and stationary breech, by means of projections on its sides, having one part of circular and another part of wedge form, and fitting within recesses in plates, or other equivalents attached to the stock, which said recesses correspond in form with the circular part of the projections, but are wider than the wedge-shaped parts thereof, and thereby admit of a limited swinging movement of the barrel, for the purpose of exposing its rear end. 2d, The sliding collar sliding over the stationary breech and the rear end of the barrel, for the purpose of making a close joint between the barrel and breech. 3d, Though I do not claim the tube, the piston, ratchet bar, and spring, separately, or irrespective of the particular arrangement shown, I do claim their particular arrangement, whereby the following results are obtained, viz; 1st, A sure forward movement of the caps without the assistance of a spiral spring. 2d, Convenience for replenishing the tube without removing it from the stock; and, 3d, The explosion of a cap already on the nipple, without bringing another from the magazine."

74. For an *Improved Device for Grooving Boards;* Geo. C. Fisk, Dansville, N. York.

Claim.—"I claim the excavator or bitt, in connexion with rotary saws, for tonguing and grooving boards, at the same time that their surfaces are planed."

75. For an *Improvement in Melodeons;* Orange N. Frary, Ansonia, Connecticut.

Claim.—"I claim the method of using two sets of reeds in a melodeon with one set of keys, in such a manner as to combine any two, or all four of the parts, (each part containing one-half of a set of reeds,) at pleasure, by the aid of an air tight wind chest, and four valves."

76. For an *Improvement in Salt Packing Machines;* John G. Fulton, Middleport, O.

Claim.—"I claim, 1st, The conical stampers having radial grooves. 2d, The yielding tooth in this connexion to enable the commencement of the lifting action, without damage to the teeth."

77. For an *Improvement in Radiators;* John Gemmil, Mercer, Pennsylvania.

Claim.—"I claim the suspension, within a radiating case, of a deflector and regulator."

78. For an *Improvement in Brick Presses;* Josee Johnson, Fort Smith, Arkansas.

Claim.—"1st, The combination of the double cam or cams, at the end of the lever or levers, and attached to and acting upon the plunger or plungers, and their friction rollers. I further claim, for the purpose of operating the cut-off, the combination of the two levers with the friction wheels, or their equivalents, at the end of the sweep."

79. For an *Improvement in Fire Arms;* Daniel Knight, Salem, Indiana.

Claim.—"I claim the horizontal sliding hammer, combined with the operating mechanism which constitutes the trigger, in combination with the barrel, which has the nipple in its breech, when said barrel is arranged forward from the hand of the shooter, and in front of the protection shoulder formed by the tube."

80. For an *Improvement in Spring Bed Bottoms;* William H. Merriwether, New Braunfels, Comal County, Texas.

Claim.—"I claim the spring bottom construction, of zig-zag wire."

81. For an *Improvement in Refrigerators for Marine Engines;* Joshua Merrill and George Patten, Boston, Massachusetts.

Claim.—"We claim the concentric tubes, and the chambers above and below the same, whereby the condensed steam or hot water is conducted into annular spaces separated

into thin films, and brought into contact on both sides with cold surfaces, the cold water or cooling medium passing through one set of pipes, and around the others. We also claim providing a separate vessel or receptacle, through which the injection water drawn from the condenser by the air pump, is made to pass before entering the refrigerator, so as to permit the oil to be separated and drawn off from the water."

82. For an *Improvement in Buggies;* James S. M'Clelland, Jefferson, Indiana.

Claim.—"I claim the arranging of the body upon spring couplings, in such manner as that additional pairs or sets of springs shall come into action as the weight is increased on the body, and this, in combination with the fastening of the body forward of its centre to one set of springs, and in rear of its centre to another set of springs, so that the body may have a rocking motion transversely, and the tendency of the body to yield at one point be counteracted by its lifting the spring in another point."

83. For an *Improvement in Machines for Making Bricks;* John McMurry, Lexington, Kentucky.

Claim.—"I claim, 1st, The combination with one or more mould cylinders, having moulds arranged as described, of as many plunger heads and plungers as may be desired, said plunger heads being arranged to work readily to the cylinders, and operated by any suitable means, whereby they are caused to compress the clay in the moulds. 2d, Arranging two mould cylinders parallel with each other, and placing between them two plunger heads attached to the same rod, or otherwise arranged so as to work in a line or plane passing through the axes of both cylinders, and thereby to cause one to advance towards its cylinder to compress the clay in one or more of the moulds as the other recedes from its cylinder after a similar operation. 3d, The method of giving motion to the mould cylinders during the receding movements of their respective plungers, by means of the toothed wheels upon the cylinders, the levers on the cylinder shafts, and their pawls, and the coupling rod, which has arms with which the plunger heads come in contact at a proper time during their movements. 4th, The method of locking the cylinders during the advance of their respective plunger heads, and of setting them free to turn during the receding thereof, by means of the catches attached to the frame, the hooks connected with the plunger heads, and a spring applied to the catches."

84. For an *Improvement in Sofa Bedsteads;* Stanislas Millet, City of New York.

Claim.—"I claim, in combination with a spring bottom, the attachment of the sagging bottom to the hinged head and foot board, so that said sagging bottom shall be strained over the spring bottom, when the head and foot pieces are dropped to form a bed, and serve the purpose of a lining between the mattrass and the springs, when used as a sofa or lounge."

85. For an *Improvement in Machines for Graduating Carpenter's Squares;* N. Millington and D. J. George, Shaftsbury, Vermont.

Claim.—"We claim, 1st, The arrangement in a single frame of as many gravers as there are units to be divided, so as by the action of the cam wheel, or its equivalent, simultaneously to trace, of the proper length, each set of division and fractional lines. 2d, The balance-frame, with its appendages, to equalize the pressure of the spiral springs on the graver handles, so as to give the same depth of mark on the thin as on the thick end of the taper square. 3d, The inclined plane, with its appendages, for moving the square longitudinally, and dividing the inch into any desirable number of equal parts. 4th, The carriage, arranged to press the square up against the points of the gravers, by a cam or otherwise."

86. For an *Improved Spring Body Carriage;* Alexander Moffitt, Brownsville, Penna.

Claim.—"I claim the construction of the body of wheeled carriages of a pair of metal springs, so formed and arranged that the curved portions thereof supporting the seat, shall admit of greater flexion, while their connexion with the horizontal portions of said springs is kept up, thus uniting the hind axle and front bolster, for the purpose of reducing the weight and expense of construction."

87. For *Improved Wooden Pavements;* Samuel Nicolson, Boston, Massachusetts.

Claim.—"I claim to so combine or arrange the blocks or wooden portion of the pavement, that there may be cells or channels formed by such arrangement between them, as described, and for the reception of tar and gravel, or materials of like character, and that each cell or channel shall have a wooden bottom for the tar and gravel cement to

rest on, whereby, when the mass of tar and stone in each cell is pressed down by the wheels of carriages, it shall be prevented from being forced through the cavity, and be caused to be spread in lateral directions so as to maintain a firm and close joint between the adjacent blocks, such as will operate to prevent water from passing down between their joints."

88. For an *Improvement in Stone Dressing Machines;* C. T. Porter, City of N. York.

Claim.—"I claim, 1st, The employment of a rest having its face parallel with the contiguous face of the tool stock, when the said rest is rigidly attached to the ways in which the hammer and tool stock work, or forms part of the same frame therewith, and when the frame thus formed is provided with and swings from journals which fit in journal boxes suspended or supported in a suitable manner in the main framing of the machine, so that the ways may be adjusted to different angles of the surface desired to be cut on the stone, without changing the relation of the hammer, the tool, and the rest. 2d, Constructing the tool stock and arranging it relatively to the rest and the hammer, so that it is capable of vibrating, to allow the tool resting upon the surface of the stone to be carried back by the feed motion, and cause it to be driven by the blow of the hammer, not in the line of the direction of the blow, but forward, in or nearly in the line or plane of the surface desired to be produced."

89. For an *Improvement in Clover Separator;* Christian Reif, Hartleton, Penna.

Claim.—"I do not claim any of the parts of my machine, separately considered; but I do claim the arrangement of the sieves and carriers for cleaning clover seed."

90. For an *Improvement in Ventilating Railroad Cars;* Cheeny Reed and Brooks K. Mould, Chicago, Illinois.

Claim.—"We claim the method of ventilating railroad cars, by combining with a vessel or apparatus which receives a current of air through a spout or spouts by the motion of the train, or any equivalent therefor, and discharges it into the car, a hollow rotating cylinder, composed of one or more series of slats, or their open work, or the equivalent therefor, and partly immersed and rotating in water, so that as the air passes through the said cylinder, or its equivalent, on its way to the inside of the car, the dust shall be separated therefrom by impinging on the moistened surfaces, whilst the rotation of the said cylinder in water has the effect to wash off the accumulated dust, and to keep the surfaces presented to the passage of the air constantly in a moistened state."

91. For an *Improvement in Machines for Cutting Boot and Shoe Soles;* Luther Ross and Potter G. Ross, Worcester, Massachusetts.

Claim.—"We claim placing the curved knives upon an axis, so that their cutting edges shall correspond to portions of the surface of the cylinder, so that a small portion only of the knife is cutting at any one time, for the purpose of cutting soles for boots and shoes. We claim the driving of the feed rolls by the adjustable wheel, in combination with the arrangement of the table and guide rail."

92. For an *Improvement in Cartridges;* Horace Smith and D. B. Wesson, Norwich, Connecticut.

Claim.—"We claim the employment in the cartridge of the metallic or indurated disk or seat plate, so that it shall rest directly on the powder, in combination with arranging the priming or percussion powder in rear of said disk, or on that side of it opposite to that which rests against the powder; our said arrangement of the disk and priming affording an excellent opportunity for applying the force of the blow by which the priming is inflamed, such force being applied in the line of the axis of the cartridge."

93. For an *Improvement in Lard Lamps;* Ira Smith and John Stonesifer, Boonsboro', Maryland.

Claim.—"We claim the improved piston, composed of two adjustable compressing plates that embrace between them a disk of leather, or other equivalent material, the said disk having an outwardly tapering independent piece, inserted into a corresponding shaped recess, so that as the periphery of said piston wears away by use, it may be enlarged by simply loosening its compressing plates, drawing out said piece a short distance, and then tightening said plates, and trimming off to the proper curvature the extremity of the piece."

94. For an *Improvement in Car Coupling;* Thomas B. Stout, Keyport, New Jersey.

"The nature of my improvement consists, 1st, In a device consisting of a stop affixed

to the floor of the buffer, for holding a swung coupling bolt in connexion with a forked lever and springs, by which the ordinary link or coupler is secured on the bolt when in place, yet allowing the displacement of the lower end of the swung bolt, when the cars are being thrown off the track, and at an angle thereto bring the middle of the link in contact with either side of the buffer jaws, and thus allow of self-detaching."

Claim.—"I claim the arrangement of the stop, springs, coupling bolt, in connexion with the ordinary link, for the purpose of admitting of self-detachment of the cars by the end of the bolt being thrown. Also, said stop, springs, bolt, link, in combination with the forked lever operated by the windlass, for the purpose of detaching in safety a car or cars at the will of an attendant, while the train is in motion."

95. For an *Improvement in Applying Springs to Window Sashes;* Albert G. Safford, Boston, Massachusetts.

Claim.—"I claim the slide or slides, and the springs, with respect to the window sash and the rectangular groove of the stile or jamb of the frame, whereby the two sides of each slide are pressed at once by the springs against the two right angular sides of the groove, and the sash forced in two directions, and particularly against the weather side of the groove."

96. For an *Improvement in Machines for Cutting Boot and Shoe Soles;* J. Thompson, Marblehead, and A. S. More, Lynn, Massachusetts.

Claim.—"We claim, 1st, The combination of the sector and pinion with the cylinder and clamp spring, operating in the manner described. 2d, We do not claim the mere adjustment of the crank and eccentrics on the shaft; but we claim communicating both a vertical and intermittent rotary motion to the knives from the continuous motion of the fly wheel, by the eccentric operating the vertical slides which support the cutter shaft, and the geared cylinder, or its equivalent, engaging and disengaging with said shaft, and operated by the sector, or its equivalent, the motion of which is derived from the crank, whereby we are enabled to secure the partial ascent of the knives before the commencement of their revolution, by the proper adjustment of the eccentrics to the crank. 3d, Passing the screws which confine the knives to the cutter head through the sliding boxes, for the purpose of adjusting the knives to different widths of toe and heel, without loosening the screws which confine them to the cutter head."

97. For an *Improvement in Hame Fastenings;* Edward Turner, Baltimore, Maryland.

Claim.—"I claim a curved rack fitted to traverse in a groove provided with a vibrating catch operated by a spring."

98. For an *Improvement in Furniture Casters;* Philos B. Tyler and Benj'n. Lathrop, Springfield, Massachusetts.

Claim.—"We do not claim the metallic caster roller, but we do claim the caster roller as made, both externally and internally, with a bended rim united to an annulus or disk, made flat for some distance from the rim towards the hub, the bended rim and flat disk producing a saving of the usual amount of metal which would have to be employed in the angles between them, in order to insure the requisite strength and stiffness to the roller."

99. For an *Improvement in Self-Heating Smoothing Irons;* William Wickersham, Boston, Massachusetts.

Claim.—"I claim the making of the handle in part or in whole, the reservoir for containing the combustible fluid. Also, combining with the bottom of the flame chamber one or more connexions or columns extending therefrom, and for the purpose of intercepting heat and conducting it downwards into the bottom of the flame chamber. I do not claim the mere application of a non-conducting material to a surface, in order to prevent the escape of heat therefrom, but I claim the non-conducting material arranged on the top of the iron, in combination with conductors leading from the top of the flame chamber down to the bottom of said flame chamber, by which combination the surplus heat in the top of the flat is saved and conducted into the bottom of the iron."

100. For an *Improved Document File or Holder;* H. E. Woodburg, Washington, D. C.

Claim.—"I claim the box or compartment document file, consisting of a box part and spring plate or holder, the said holder being hung or attached to the spring at its back in such a manner as to give a flexible character to the holder, and admit of its being

leaned back or to either side, to facilitate the reading of the endorsements, and the abstraction from or insertion of certain papers to the pile, without releasing the other papers from the hold of the platen, and the whole forming a more convenient file for the filing away of folded documents, and to protect them from abrasion, &c."

101. For an *Improvement in Shuttle Guards for Power Looms;* Peter Migget, Hoosick Falls, New York.

Claim.—"I claim the shuttle box-guard constructed of rollers on either side of the centre longitudinal line of the shuttle, and projecting from a spring bar or holder down into the box, whereby the shuttle is more effectually restrained from rising at the end next the warp on leaving the box, thus preventing the shuttle from flying out of the loom, or more truly inclining it to run in its course, friction is diminished, the shuttle less exposed to injury or wear, and kept from turning or entering the opposite box edgewise."

102. For an *Improvement in Furniture Casters;* Leroy S. White, Chicopee, Assignor to Benjamin Lathrop and Philos B. Tyler, Springfield, Massachusetts.

Claim.—"I do not claim making the shank of the caster detractable from its socket, nor do I claim the employment of a spring to hold it in the socket, nor the arrangement of said spring in a groove made in and around the shank, and making the spring to bear against the internal surface of the socket, made without a groove; nor do I claim the arrangement of the sustaining groove of the spring in the socket instead of in the shank, so that when the shank is being drawn out of the socket, or when it is within or out of the same, the spring will remain in the socket; but what I do claim is, the mode of arranging or applying the spring and the sustaining groove or recess thereof, to the socket tube and the shank, the sustaining groove of the spring being made to embrace the socket tube, and project through and into the groove of the shank."

103. For an *Improvement in Sewing Machines;* Alfred Swingle, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"I claim the combination of the rotary fork thread carrier and the hook, as made to operate in connexion with the needle, and perform sewing."

104. For an *Improvement in Blasting Rock, Timber, &c.;* John Norton, Cork, Ireland.

Claim.—"I do not claim the percussion cartridge, the frictional pill box, or the frictional cork, as herein described; but I do claim, 1st. The frictional cord divided in two parts and slightly spliced together, in combination with an inflammable compound with which the splice is covered, as described. 2d, The safety bridle guard, constructed and applied as described."

105. For an *Improved Mode of Constructing Iron Buildings;* Amos J. Saxton, Brooklyn, New York.

Claim.—"I do not claim the mortises, tenons, lugs, grooves, chamfers, common keys, or any simple dove-tail joints. I claim, 1st, The process of connecting and combining all the different points by all or any of the improved joints, so arranged at all the different points by all or any of the different joints, as when joined by the different joints at the sectional points, as described, the use of screws, rivets, bolts, or nails, is not required in the erection of iron frame, fire proof, or other buildings. 2d, I claim the process of erecting iron fire proof and other buildings, and of uniting or connecting each substantial part to each other, or of connecting them at all of the sectional points, by the different joints, without the use of screws, rivets, bolts, or nails. 3d, I claim the manner of so arranging and combining the different points of the columns, post, or studs, girders, beams, ashlers, and interior plates, or any of the sectional parts of the buildings, with the different joints so combined, in such a manner as when the different joints are properly united and combined with the different joints in all of the sectional parts, they form a substantial iron frame fire proof, or other building."

106. For an *Improvement in Bushing Sheaves for Ships' Blocks;* Weatherell Taylor, Camptown, New Jersey.

Claim.—"I claim securing the bush to the sheave by fitting the flanch into the recess on one side of the sheave, and the bevel edged ring into the recess on the opposite side of the sheave, and swagging the bush on to the beveled edge of the ring."

107. For an *Improved Fan Blower;* Solomon W. Ruggles, Assignor to S. W. Ruggles and A. R. Smith, Fitchburg, Massachusetts.

Claim.—"I claim the application of a deflecting rib to the middle of, and so as to ex-

tend beyond the propelling surface of each of the curved wings of the blast wheel, and formed so as to deflect the currents of air entering the wheel laterally in the opposite directions, and prevent them from that contact or impulsion against one another, which produces the humming or buzzing noise."

108. For an *Improvement in Braiding Machines;* James A. Bazin, Canton, Assignor to Alfred B. Ely, Boston, Massachusetts.

Claim.—"I claim the movable guides, constructed and operating in the manner described. 2d, I claim the method of constructing the bobbin holders, the parts which carry and guide the threads being connected with the stem by means of springs which enables the bobbins to yield without permitting the strand to render too freely. 3d, And I also claim, in combination with the method of constructing the bobbin holders, the method of drawing off the finished braid over the spring plate. 4th, I claim the disk, operating in the manner described."

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109. For an *Improvement in Closing the Mouths of Bottles, etc., Air Tight;* Robert Arthur, Washington, District of Columbia.

Claim.—"I claim only the vessel, so contrived as to be made tight by means of a groove or receptacle containing a yielding medium which is to be penetrated by the cap or cover, with the receptacle so contrived that the bottle may be inverted to pour out its contents without spilling the liquid or yielding medium from the groove or receptacle."

110. For an *Improvement in Machines for Pegging Boots and Shoes;* John A. Bradshaw, Lowell, Massachusetts.

Claim.—"I claim the combination with the grooved wheel, the arm, for the purpose of presenting the pegs to the wheel longitudinally. The application of the grooved wheel, in combination with the burr wheel and tube. The levers, pawl, and ratchet, on grooved wheel, or their equivalents. The clamps or forceps to receive the peg from the wheel, in combination with the detectors, the punches, and the double channel, for the purpose of insuring the proper presentation of the peg with the point downward. The combination of the forceps, the wedge-shaped driver, and the adjustable stop screw. The apparatus for holding the boot or shoe during the operation of pegging, consisting of the plate revolving upon the ring of the plate, and having the clamps, or their equivalents. And the combinations of the hinge joints, the shaft, and the levers, or their equivalents."

111. For an *Improvement in Glass Moulds;* Wm. Brooke, Jersey City, New Jersey.

Claim.—"I claim the shoulder, when used in combination with the cap plate, in the manner set forth."

112. For an *Improvement in Hot Air Range and Side Ovens;* John H. Cahill, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, The use of the fresh hot air pipe, when constructed and combined with the hot air chamber, and elevated side oven and vent hole, especially for the purpose of preventing the fumes or vapors, (arising from the substances being cooked in the oven when in operation,) from being drawn or forced out by the oven into the hot air chamber. And, 2d, Making the elevated side oven flues of square section, and united together by the partitions, so as to leave equal and flat surfaces in the oven and hot air chamber, and arranged so as to radiate heat therefrom on all sides of the oven excepting the door side, and also so as to radiate heat into the hot air chamber from the flues on four sides of the oven."

113. For an *Improvement in Railroad Car Brakes;* M. P. Coons, Brooklyn, N. York.

Claim.—"I claim a lever form brake, which, when in action, shall bear and brake simultaneously, both upon the wheels and rails, the friction upon the latter supplying the breaking force upon the former, and the whole being adjustable and self-acting, through the combined agency of an eccentric or cam-bearing or resting point between the brake and car."

114. For an *Improvement in Machines for Turning Irregular Forms;* A. D. Crane, Newark, New Jersey.

Claim.—"I claim the cutting wheel, combined together, guided and controlled in the manner set forth."

115. For an *Improvement in Rakes;* D. M. Cummings, Enfield, New Hampshire.

Claim.—"I claim the mode of fastening the head of the rake to the handle or tail, by the use of the head fastener containing the socket and the clasp, in combination with the handle, the head, and the screw."

116. For an *Improved Hand Press;* B. Franklin Day, Philadelphia, Pennsylvania.

"The nature of my invention relates to the method of arranging the levers, toggle arms, and follower, so that by grasping the said levers in the hand, the follower will be brought down to the block or bed; that is to say, by hinging the hand levers to the stock, and the follower to the hand levers, by means of the toggle arms."

Claim.—"I claim the so arranging of the levers, toggle, and follower, as that by grasping the handles of the levers in the hand of the operator, the platen shall be brought down hard upon the bed."

117. For an *Improved Mode of Securing Hubs to Axles;* Cook Darling, Utica, N. Y.

Claim.—"I do not claim the holding on the wheel by means of a groove encircling the front end of the axle; nor operating the guard plates or collar closing over the groove, by means of the key in front, nor simply the conical end of the axle; but I claim the combination and arrangement of the several parts, viz: the axle with the conical end, the guard plates, and the means of operating the same by the use of the key in front."

118. For an *Improvement in Punches and Dies for Punching Watch Hands;* Aaron L. Dennison, Roxbury, Massachusetts.

Claim.—"I claim the construction and arrangement of the punch and die, the punch being of elementary parts formed to the same figure, or nearly so, in their cross-section throughout their whole depth, and braced between blocks or clamps made to the figure of the article to be formed, by which construction the most delicate and complex punch can be formed in a cheap and expeditious manner, and readily renewed or changed, and being throughout of the same magnitude, are readily and perfectly hardened without injury, which has heretofore been found an insuperable difficulty in punching small delicate work."

119. For an *Improvement in Ploughs;* Joshua Gibbs, Canton, Ohio.

Claim.—"I claim making the working surface of the mould board in the form of a section of the interior surface of a hollow cylinder, the centre or axis of said cylinder being parallel, or nearly parallel horizontally to the base of the mould board or bottom of the plough."

120. For an *Improvement in Lamps;* Joseph Harris, Jr., Boston, Massachusetts.

"The nature of my invention consists in a new mode of producing a centre draft in lamps; also, of increasing and decreasing the light."

Claim.—"I claim the arrangement and construction of the lamp."

121. For an *Improved Safety Apparatus for Steam Boilers;* A. H. Judd, St. Louis, Mo.

Claim.—"I claim passing the stem of the valve through an enlargement in its supporting tube, by which I am enabled to give short bearings to said stem, for the purpose of preventing it from becoming fastened in its bearings by oxidation, or the action of the heat upon the earthy matter driven through the same when the valve is opened, and also for the purpose of producing a fuller and clearer sound when the valve is opened, than is produced by the escape of steam through the ordinary gauge cock. Also, removing portions of the sides from that part of the valve stem which passes through its inner bearing aperture, so as to leave narrow bearing surfaces to guide and steady the valve, for the purpose of preventing said valve stem from becoming fastened within its inner bearing aperture, and also for causing a large volume of steam to escape and give the alarm when a leak of water in the boiler, or excessive heat of the steam, causes the float to sink. Also, combining the valve stem with the float, in such a manner that when the float shall sink and open the valve, the valve stem may be detached therefrom, for the purpose of again closing the same, by simply giving a partial turn to said valve stem by means of its handle. Also, giving an alarm whenever the steam in the boiler is allowed to accumulate to a dangerous degree of pressure, by placing a plug of fusible alloy in an aperture in one end of the float, which is connected with my improved arrangement of gauge cock."

122. For an *Improved Grindstone Frame;* J. L. Lord, Chester, Connecticut.

Claim.—"I claim the grindstone frame, cast in two pieces of such form that when

put together it shall furnish the bearing for the shaft and friction roller, both of which shall be protected from injury and from dust or water, and also from being displaced from their positions in the frame, either by accident or design."

123. For an *Improvement in Railroad Car Brakes;* Thos. G. McLaughlin, Philadelphia, Pennsylvania.

Claim.—"I claim forking the sliding rod in such a manner as not to interfere with the king joints and bumpers, but to have a longitudinal motion separate from and independent of both. Also, the slotted connecting rods attached to the sliding rod for causing the automatic action of the brakes without interfering with the ordinary hand brake, or the hand brake in its action interfering with or producing any movement of the sliding rod."

124. For an *Improvement in Harrows;* Jacob Myers, Powhatan Point, Ohio.

"The nature of my invention consists in the construction, on the teeth of the harrow, of oblique wings, the teeth being arranged upon a beam running obliquely to the main beam of the implement."

Claim.—"I claim the triangular wings upon the turned up portion of the teeth with thin land sides, so inclined as to have a tendency from the plant, when the implement is moving forward, constructed and arranged for pulverizing the earth, and otherwise facilitating the cultivation of cotton."

125. For an *Improvement in Lime Kilns;* Robert Neisch, City of New York.

Claim.—"I claim, in combination with the fire chamber, the air conducting passage, for the purpose of bringing in the air from above the fire. Also, in combination with the arched fire chamber, the inclined and curved hearth, for concentrating the fuel and throwing the flame or heat towards the stack."

126. For an *Improved Mode of Unloading Coal and other Cars;* Andrew Patrick, Allegheny County, Maryland.

Claim.—"I claim the manner of liberating the pin which holds the door of the car, by a lever attached to said pin, calculated to lift it and open the door when the car enters upon a tilting frame. Also, the iron bar upon a tilting frame forming a hook to hold the car, and, at the same time, a means of lifting the lever to open the door of the car, or, in other words, the combination of this lever and tilting frame to facilitate the unloading of mine cars."

127. For an *Improvement in Sewing Machines;* Sylvester H. Roper, Worcester, Mass.

Claim.—"I claim the groove, tube, or thread passage, in combination with a needle made to operate a thread, said passage being for the purpose of supporting the thread and preventing it from kinking or injuriously springing back or towards the cloth, immediately after the release of the thread from the needle. I do not claim the intervention or employment of a slide, or an equivalent contrivance, to close down on the barb and over the opening of the hook of a needle; nor do I claim the application of such closing slide to a hook needle in such manner that said slide shall play or move in a groove made in the side of the needle, as the same does in the machine patented by William Wickersham on the 19th day of April, 1853; but what I do claim is, the making the shank of the needle tubular, and inserting the closing slide within the same, whereby such closing slide is better protected from accident, or being broken by catching in the cloth or thread, or otherwise broken, as it is liable to be, when made to run in a groove formed in the side of the needle. And, in combination together, and used with a hook needle, I claim the two thread benders, as made to operate on the thread, and lay it in the opening of the needle. And, in combination with the thread benders, I claim the lip or nipper, and the spring nipper, the same being for the purpose of seizing the thread and enabling the needle to draw it closely into the cloth. I also claim the mode of connecting the two connecting rods to one crank pin, viz: by the projections from the rods and the covering tube or ferule."

128. For an *Improvement in Turn Tables;* Jacob C. Robie, Binghampton, N. York.

Claim.—"I claim balancing the platform of the turn-table upon a transverse central shaft, or other suitable axis, resting on the roller carriage in a line intersecting the line of the axis upon which the turn-table rotates, in such a manner that the table, when in a horizontal position, is elevated, or has its rails above those of the track, to admit of the free swing of the table over its under supports or bearings, and so that the table may be

rocked with facility from its centre, or tilted to bring the ends of its rails on either side of the balancing shaft, into line or level with the rails of the track. Also, the manner of holding the table steady at its horizontal set whilst rotating, and tilting or depressing it on either side of the balancing axle when required, by means of the cams arranged to bear upon the roller carriage, and operating in connexion with the roller carriage and table."

129. For an *Improvement in Machines for Cutting Irregular Forms;* O. L. Reynolds, Dover, New Hampshire.

Claim.—"I claim combining a series of patterns and the chucks for the blocks with the collar, the vertical slides, the pawls, the ratchet wheels, and the recesses in the arms, or their equivalent, in such a manner that said series of patterns shall have corresponding compound rotary and longitudinally reciprocating movements imparted to them. Also, supporting the weight of the cutter wheel upon a series of rotating and longitudinally reciprocating patterns when said patterns are combined with chucks for a series of blocks, in such a manner that corresponding movements shall be imparted to said patterns and blocks, and said blocks be so situated as to be operated upon by the cutters."

130. For an *Improvement in Machinery for Combing Wool;* Charles G. Sargent, Lowell, Massachusetts.

Claim.—"I claim, 1st, Drawing out and stapling the material previous to commencing the combing operation. 2d, The continuous motion of the nippers, or other parts which operate upon the wool, whereby I am enabled to keep a number of them in operation at the same time, the different steps in the process proceeding simultaneously upon different portions of the material, without the necessity of interrupting any one of them for the performance of another, and without retrograde motion of any of the parts of the machine. 3d, The method of opening and closing the nippers by means of the cam, in combination with the cam, or its equivalent, whereby the nippers are closed suddenly upon the wool, whatever may be the rate of motion of the nipper cylinder."

131. For an *Improvement in Railroad Car Windows;* George Spencer, Utica, N. Y.

Claim.—"I claim the combination with the side of a car of a revolving window, consisting of two separate circular sashes connected by hinges, so that one sash may be opened to its full extent, and having a small part of the circle cut off, so that by revolving it upon its centre, a small opening may be made at the forward part of the window, which ever way the car may be moving, the residue of the window remaining at the same time covered."

132. For an *Improvement in Fire Arms;* William A. Sweet, Pompey, New York.

Claim.—"I claim, 1st, Producing the compound longitudinal and vibratory movement of the breech, and afterward immovably securing it in contact with the barrel by a single forward and return motion of the actuating lever, viz: by means of the cam piece provided with a shoulder, a cam surface, and a wedge surface, against which, said lever acting successively, produces respectively the backward longitudinal and vibratory motion of the breech, then the forward longitudinal motion thereof, and finally presses it against the barrel with immense force. Also, the link, one end of which is hinged to the lever, and the other end provided with a slot that receives a pin on the hammer dog, when arranged and operated for the purpose of cocking the gun by the action of the actuating lever in operating the breech, while, at the same time, the hammer remains free to be raised in the ordinary way without moving said lever. Also, the arrangement of a broad cavity in the face of the hammer, with a sharp edge on its rear side, in combination with the compound movement of the breech, and the properly regulated motion of the hammer, for the purpose of removing the exploded caps from the nipple. Also, the combination of the mouth-piece, attached to the extremity of the feeding tube, and provided with a notched tongue projecting forward from one side, and of the short tube which is held in front of said mouth-piece by a spring, and has a wedge-shaped projection extending forward from the side, opposite to the tongue, when the whole being situated and arranged in such a manner as to receive the nipple and supply it with a cap whenever the breech is fully opened."

133. For an *Improvement in Seed Planters;* J. P. Wait and L. J. Wait, Waterloo, S. C.

Claim.—"We claim making one wheel larger than the other, and putting them on separate axles, so as to make one operate the bur, or apparatus which stirs the seed, and

the other the burr or apparatus which delivers the seed, without the aid of gearing or other equivalent devices."

134. For an *Improvement in Horse Rakes;* Moses D. Wells, Morgantown, Virginia.

Claim.—"I claim the method of regulating the action of the rake teeth by the reverse anti-friction rollers."

135. For an *Improvement in Insulators for Lightning Rods;* Timothy W. Webb, Jersey City, New Jersey.

Claim.—"I claim making the inner surface convex, in the manner described."

136. For an *Improved Process for Printing Long Napped Fabrics;* Wm. A. White, Roxbury, Massachusetts.

Claim.—"I claim the process of coloring and finishing a napped fabric after the fibres have been laid in one direction by the ordinary or common process of finishing them, the said process consisting in raising and turning the fibres over and down upon the cloth in a contrary direction, and printing figures or devices upon them, in one or more colors, and finally returning the fibres or restoring them to their original positions or directions."

137. For an *Improvement in Gold Amalgamator;* A. S. Wright, San Francisco, Cal.

Claim.—"I claim the method for amalgamating gold in hollow revolving cylinders, upon horizontal axes, said axes, journals, or trunnions being hollow to admit the pulverized quartz or ore from one cylinder into another, the inlets through the trunnions being smaller than the end of the outlet; the said cylinders connected by flanches or pipes with grooves turned into the axes or trunnions, and rings fitted into the grooves, and covered by the flanches, the whole being so connected as to make them water or steam tight, and so arranged as to give a fall of about six inches to each cylinder, said cylinders containing rollers, knives, burnishers, and other analogous arrangements, to produce friction, scour the ore, and produce the amalgam with quicksilver."

138. For an *Improvement in Machines for Pegging Boots and Shoes;* Wm. Ridder, Assignor to Wm. Ridder and Nehemiah Hunet, Newburyport, Massachusetts.

Claim.—"I claim the combining with the handle of the machine, and the machinery for driving the pegs, a feeding mechanism, by which, under the movement of the awl stock, the feeding, or regulating of the feeding of the machine along on the sole, is effected. Also, the combination of mechanism, by which the feeding of the machine is regulated while the machine is held in the hand and pressed against and along on the edge of the sole, the said combination being the serrated wheel, the spring catch, the slide, and the cam on the awl driver or stock. Also, the combination of the movable or sliding peg receiver with the peg wood carrier and the awl driver or stock, the same being applied and made to operate as stated."

139. For an *Improvement in Winnowers;* Henry H. Beach, Chicago, Illinois.

Claim.—"I claim the board, (delivering the grain to the front edge of the blast,) in its arrangement with the drum and the inclined planes."

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140. For an *Improved Centrifugal Pump;* William D. Andrews, City of New York.

Claim.—"I claim the construction of the pump, as described, viz: having a hub in the shape of the base of a cone inverted, with arms attached to its periphery of a gradually decreasing width as they approach its base, placed within a shell corresponding in shape to the outer circumference of the arms, and having induction passages of a spiral form gradually decreasing in pitch to their point of delivery, and eduction passages of a spiral form, of a gradually increasing pitch until they attain a straight line; by which construction the water is made to pass without sudden change of direction or eddies in an unbroken volume through the pump. I do not limit myself to the precise mechanical construction, as shown, but may modify the different parts, only retaining the same general combination."

141. For an *Improvement in Hot Air Furnaces;* Nathaniel A. Boynton, City of N. Y.

Claim.—"I claim, 1st, The arrangement and construction of the dome and heating ring surrounding the same, combined by a series of pipes opening into the base of the dome, and carrying the smoke up over the same. Also, the construction and arrangement of the smoke pipes, so as to prevent the lodgement of dirt therein, and precipitate

the same into the fire chamber, thereby preventing the clogging of said pipes. Also, the puppet valve cover, arranged and combined with the dome of the furnace, by which I insure a stopper at that point not liable to the derangement of ordinary valves used for similar purposes."

142. For an *Improvement in Rotary Engines;* Richard C. Bristol, China, Michigan.

Claim.—"I claim the resting of the outer cylinder by lugs upon a convex bearing, with a plate interposed and made adjustable by set screws, or by wedges, for the purpose of adjusting the outer cylinder to any and all possible variations of the shaft and inner cylinder. Also, driving out the slides by steam acting under pistons at each end of them, two being drawn out in equilibrio, while the other two are being acted against to propel the engine. Also, using a cock or valve in the exhaust pipe, to be closed before starting the engine, for the purpose of filling the engine with steam, and causing the pistons to force out the slides, which fall back upon stopping the engine. Also, the metal rings upon the outer head, fitted over elastic packing, and forced up to the ends of the cylinder by springs, for providing for the expansion and contraction of the metals. Also, in combination with the rings thus forced up, the use of set screws for restraining the action of such springs, and preventing the atmosphere from causing undue pressure or friction on said rings. And, also, the peculiar method of making the joint in the abutment, so as to be adjustable and perfect on the face of the inner cylinder at the end of the abutment and on the periphery of the inner heads."

143. For an *Improvement in Hominy Mills;* Benjamin Bridendolph, Clear Spring, Md.

Claim.—"I claim the compound spiral hulling shaft, operating in connexion with a roughened concave for hulling and breaking corn."

144. For an *Improvement in Straw Cutters;* Absalom B. Earle, Franklin, N. York.

Claim.—"I claim the arrangement of a vibrating knife and recoil spring, as set forth. Also, the arrangement of a chopping knife on vibrating arms fitted on each side with a handle, in such manner that the force of the blows of the knife may be varied in proportion to the quantity of straw to be cut, and by which the operator may work on either side of the machine at pleasure."

145. For an *Improved Arrangement of the Steam Engine;* Wm. M. Ellis, Washington, District of Columbia.

Claim.—"I claim the arrangement of the annular cylinder and piston between the crank and cross-head, and uniting the two latter by a connecting rod passing through the space within the two former."

146. For an *Improved Stop and Waste Cock;* Wm. Z. Hatcher, Philadelphia, Penna.

Claim.—"I do not claim making a supply way in the barrel of the cock, the outlet waste hole, the waste pipe, nor the through ways; but I claim making the waste way in the barrel of the cock, so as to convey the water required to be wasted from the pipe to the through way in the plug, that it may pass through the same to the outlet hole and pipe on the opposite side of the barrel, and so that the plug may be turned in either direction for the purpose, and the notch or extra hole in the plug, and the check pin and stops heretofore used may be dispensed with."

147. For an *Improvement in Portable Bureaus;* Levi Heywood, Joseph L. Ross, and Jas. K. Otis, Boston, Massachusetts.

Claim.—"We claim forming in a bureau or case of drawers which is susceptible of dismemberment, an independent frame or case, which, when the parts are disjointed, and the back of the bureau attached to it, serves as a box or case to receive the front, back, and end pieces of each drawer, the pieces which compose each drawer being packed in the same compartment of this independent frame, in which the said drawer slides when put together."

148. For an *Improvement in Apparatus for Coating Telegraph Wires;* James B. Hyde, City of New York.

Claim.—"I claim the employment of the moulding kettle, with or without the melting kettle, provided and combined with an aperture covered with a disk of india rubber, or its equivalent, having a hole or puncture in the centre which admits the wire and prevents the escape of the contained composition, and with the nozzle or die, for determining the thickness of coating of compound to be put on the wire. And, also, the use of

the cone, (which determines the thickness of the coating,) in such manner as that the outer end or nozzle thereof shall, when in use, terminate in and be covered by water, so that the covered wire shall emerge from the cone directly into, or while the latter is in the water, through which the wire will then pass, for the purpose of cooling the composition. And, finally, I do not claim the use of the apparatus solely for the purpose of covering telegraphic wires, but it may be applicable and useful for other equivalent uses."

149. For an *Improvement in Actuating Engines by Bi-Sulphuret of Carbon;* Bernard Hughes, Rochester, New York.

Claim.—"I claim the application of bi-sulphuret of carbon to any convenient form of the steam engine, as a motive power, when the vapor of said substance, after it has passed through the cylinder, is condensed by any known means of producing condensation, in a suitable reservoir, and preserved for the future supply of the boiler."

150. For an *Improvement in Knitting Machines;* George Jackson, Cohoes, N. Y.

Claim.—"I claim the arrangement and combinations of the pressers and sinkers in the frame, in the manner whereby they move together and can be adjusted at such distance apart as may be requisite to graduate the size of the stitches, as required. Also, the arrangement of the cams which are attached to the cam wheels on one common shaft, to produce the relative movements of the pressers, the sinkers, the needles, and the thread carrier bar, with the carriers, in combination and co-operation with the movement of the face cam, which cam being revolved by the movement of the shaft through the spur gear wheels, produces the relative movements of the thread carriers to the right and left, and under and above the needles, and gives the peculiar character and figure of the fabric knit, so that by changing the surface of the face of cam, and altering the relative proportions of the spur wheels to each other, the figure of the fabric may be altered indefinitely."

151. For an *Improvement in Floating Drags or Anchors;* A. F. Lewis, Shopiere, Wis.

Claim.—"I claim the arrangement of the canting hawser, cable, and floating anchor, whereby a vessel may be held with more or less power, as circumstances require, where ground anchorage is unattainable."

152. For *Apparatus for Balancing and Hoisting Sashes;* Robert Marquis, Xenia, O.

Claim.—"I lay no claim to making both sashes mutually operative by means of the same cords which serve to elevate and lower said sashes; but I claim the single cord, which, passing around pulleys at the mid-width of the sashes, is operated by a winch in the jamb, enabling the simultaneous or separate movement of each sash without liability of binding by the unequal expansion of different portions of the cord, or impairing the strength of the sash by the removal of its substance, and for other objects of utility."

153. For an *Improvement in Manure Spreaders;* Elbridge Marshall, Clinton, N. J.

Claim.—"I claim the employment of the vibrating brush."

154. For an *Improvement in Grain Mills;* Henry Mellish, Walpole, N. Hampshire.

Claim.—"I claim the arrangement of the ring saws, as set apart by the washers on the bolts, with the cracker rest inclosed by them, in combination with the adjustable case, or its equivalent, for the purpose of cracking ears of corn, and also shelled grain, that it may be the more readily received between the burr and the grinding surface of the adjustable case, and for the further purpose, by the oblique direction of the teeth on the outer edges of the ring saws, and that of the teeth on the inner surface of the adjustable case, of forcing the cracked grain into the space between the periphery of the burr and the grinding surface of the adjustable case. Also, the arrangement of the burr, constructed as above described, in combination with the finishing plate, and the adjustable case, or its equivalent, operating as the burr does, conjointly with the ring saws, or inside the adjustable case, and the toothed disk of the finishing plate against the front surface of the adjustable case, for the purpose of further grinding and giving the required degree of fineness to the meal as it passes between them."

155. For an *Improved Diaphragm Pump;* Julius A. Pease, City of New York.

Claim.—"I claim the elastic diaphragm, with the metallic or wooden cylinder, in combination with the air chamber."

156. For an *Improvement in Wood Gas Generators;* W. D. Porter, City of N. York.

Claim.—"I claim the construction of a gas apparatus or still, consisting of a metallic or other cylinder, the cones, diaphragm plate, and exit pipe."

157. For an *Improvement in Folding Umbrellas;* Henry Richardson, Sheldon Morris, Jr., and Bennet C. Perry, Litchfield, Connecticut.

Claim.—"We claim, 1st, The combination of the spring and its hook or catch with the hinge, the said spring being secured to one part of the hinge or rib, and the hook or catch taking into a notch in the other part of the hinge or rib, when the two parts of the rib are in line, for the purpose of making the joint rigid. 2d, Attaching the several joints or parts of the stick together, by means of a link which is connected to the end of the male screw, and has a ring, or equivalent, fitting in a hollow part behind or within the nut, which prevents its passing through the nut, but which at the same time allows the screw to turn freely within the nut."

158. For an *Improved Instrument for Manufacturing Door Knobs;* Artemas Rogers, Painesville, Ohio.

Claim.—"I claim the instrument, or its equivalent, by the use of which I am enabled, with one and the same instrument in continuous use, to form the screw threads or other impressions within the socket of a door knob, remove the knob from the mould to the polishing furnace, manipulate it during the fire, polishing, and finally deposit it in the annealing kiln."

159. For an *Improved Pavement Washer, Hose Hydrant, and Hitching Post;* Charles M. Alburger, Philadelphia.

Claim.—"I claim, 1st, Making a double waste cock by cutting the two waste notches, or their equivalents, in the plug of the cock, so that either notch may be put in communication with the usual waste holes in the barrel, by turning the plug in either direction, when the said double waste cock is used, in combination with a pavement washer, hose hydrant, or other hydraulic apparatus requiring the water in the outlet pipe above to waste in the ground below when the reservoir pressure is shut off by turning the plug of the cock; and, 2d, The general arrangement and combination of a pavement washer, hose hydrant, and hitching post."

160. For an *Improvement in Manufacturing Two Ply Carpets;* Thomas Crossley, Boston, Massachusetts; ante-dated February 22d, 1854.

Claim.—"I do not claim the manufacture of carpets composed of different fibrous materials, in which the whole or nearly all of one fibre is shown on one side of the carpet, and all or nearly all of the other fibre on the other side of the carpet, as this has been done in pile carpets and other fabrics; but I claim as a new article of manufacture, a two ply ingrain carpet, having the lower ply composed entirely of linen or cotton, and the upper ply of wool, when united, in the manner described, for the purpose of producing a durable and economical carpet, to be subsequently printed upon one side, in the manner described."

161. For an *Improved Daguerreotype Plate Holder;* Joseph Hill, Skaneateles, N. Y.

Claim.—"I claim the application of the inward pressure by means of the springs, by their force retaining the daguerreotype plates to the block by the contact of the daguerreotype plates, with the plates on the edges of the block. It is understood that the daguerreotype plates may be confined by their ends as well as sides; by the same principle, blocks may be made of any substance."

162. For an *Improvement in Tuning Forks;* Joseph C. Jinkins, Bealsville, Ohio.

Claim.—"I claim producing sounds of any required pitch with a single tuning fork, by means of a movable cross bar inserted in the proper positions between the prongs of the fork."

163. For an *Improved Means for Preventing the Explosion of Boilers;* A. W. Jones, City of New York.

Claim.—"I am aware that contrivances have been made by which the valve, which is raised by the pressure of steam, is made to open another valve for its escape from the boiler; and I therefore do not claim to have been the first to have made such a discovery; I claim the combination of the rock shaft with the slide valve, piston, spring valve, and steam chest, in the manner described."

164. For a *Machine for Sawing Clap Boards, &c.;* D. F. Mellen, Wentworth, N. H.

Claim.—"I do not claim two saws operating simultaneously upon opposite sides of the same piece of lumber; but I do claim the arrangement of devices by which the distance between the saws is varied to meet the varying thickness of the logs to be sawed, and the saws, when so adjusted, are elevated and depressed together, as required. I claim the method of feeding the log between each successive cut of the saws; that is to say, causing the feeding pawl, or the lever which carries it, to strike against a fixed stop, in combination with the yielding dog. I claim the method of raising and lowering the saws, when it is desired not to use them at the same time, but alternately, during the forward and backward motion of the log, the same being effected by the combination of the unlocking, shifting, and locking apparatus, in combination with the lever and chains, the whole operating in the manner set forth."

165. For *Improved Saw Set;* William O. Rust, Great Falls, New Hampshire.

Claim.—"I claim the rotary bender and its adjusting screw, in their combination with the movable lever. Also, the arrangement of the regulating back stop on the stationary arm, so that it may be used in connexion with the movable lever."

166. For an *Improvement in Securing Glasses in Lanterns;* H. Sangster, Buffalo, N. Y.

Claim.—"I claim the combination of the springs and the frame, arranged and operating substantially as set forth, not intending to claim the springs uncombined with the frame, or some device equivalent thereto."

167. For an *Improvement in Sewing Machines;* E. Shaw, East Abington, Mass.

Claim.—"I claim, 1st, The combination of the rack bar with the bar, both curved in the same shape, and forming a clamp capable of receiving a vibrating motion from the diamond shaped teeth of the pinion, and constituting a clamp for sewing the seams of boot legs. 2d, I claim feeding the clamp along, and guiding it so as to keep the leather to be sewed always in proper position with regard to the needle, and at the same distance from the same, by means of the rack gear, with its diamond shaped teeth, and proper guides."

168. For an *Improved Carpenter's Gauge;* Halcyon Skinner and Wm. Greenhalgh, West Farms, New York.

Claim.—"We claim the combination of the frame with the adjustable sliding bars, adjustable fences, and set screws, in the manner described."

169. For an *Improvement in Harness Saddle Trees;* Robert Spencer, Southport, Conn.

Claim—"I do not claim constructing the frame and cantel of a harness tree, in separate pieces, nor the insertion of leather between them; but I do claim harness saddle tree, constructed of combined iron and leather, or the equivalent of leather, the iron serving the purpose of a skeleton, and giving it the proper rigidity, while, by trimming the leather portions of the tree, the exact conformation is attained."

170. For a *Catamenial Supporter;* Alfred A. Starr, City of New York.

Claim.—"I claim the combination of the elastic spring, in the manner set forth."

171. For *Improvement in Fastenings of Ploughs;* David Swartz and Samuel Swartz, Toms' Brook, Virginia.

Claim.—"We do not claim constructing the point and cutter in separate pieces, so as to be attached and detached at pleasure, but we do claim constructing the mould board and land side with slots, as described, and the point and cutter with the tongues and flanches to fit the said slats, so that the said point and cutter shall slide in horizontally, or nearly so, and form a fastening with the mould board and land side, without the use of screws or bolts."

172. For an *Improvement in Harness Saddles;* Robert Spencer, City of New York.

Claim.—"I claim a properly shaped harness saddle seat, cast in one piece, with the unfinished jockey shaped side bars; the said seat requiring to be only smoothed and japanned to adapt it to use, and the said side bars requiring to be covered with patent leather or jockeys, or skirts of sufficient thickness to make a smooth and harmonious finish with the japanned surface of the seat."

173. For an *Improvement in Counting Machines;* Paul Stillman, City of New York.

Claim.—"I claim the employment and arrangement of the clutches, having a spring sideways, so as to catch into the face notches, and the styles outside the count wheels, by which they are operated, to move a series of count wheels, in the manner set forth."

174. For an *Improvement in Ovens;* Francis C. Treadwell, Jr., City of New York.

Claim.—"I claim the use of the combination of the furnace, flues, and dampers, in combination with an endless band running through the oven, and over drums placed outside of it, for the purpose of making a perpetual baking oven."

175. For an *Improvement in Track Clearers to Grass Harvesters;* Abner Whiteley, Springfield, Massachusetts.

Claim.—"I claim the rolling cone moving on the axis, and furnished with a joint clearer, for the purpose of clearing a track in the cut grass."

176. For an *Improvement in Cheese Presses;* Philander Wilber, Milan, Ohio.

Claim.—"I claim the combination of the two rack slides with the respective attachments of the cam and friction roller, by which means, in connexion with the slides and accompanying racks, the press is operated."

177. For *Improvements in Clamps for Sewing Machines;* Melvin Shaw, Assignor to Melvin Shaw and Daniel G. Wheeler, East Abington, Massachusetts; ante-dated February 22d, 1854.

Claim.—"I claim the combination of the sliding bar with the curved clamp and the rest, constructed and operating together, in the manner substantially as set forth, by which means, as the work is fed through the machine, it is kept constantly up to the needle, and the stitches are placed at a uniform and unvarying distance from the edges of the material, without dependence upon the care or skill of the workman."

178. For an *Improved Machine for Planing Lumber, out of Wind;* Solomon S. Gray, Assignor to S. S. Gray and S. A. Woods, South Boston, Massachusetts.

Claim.—"I claim, 1st, The peculiar construction of cutter head herein described, the cutter head itself being made use of to turn and break the shaving, in the manner of a double iron plane, and being furthermore made concave, for the purpose of facilitating this operation. 2d, I claim the clamp for the purpose of dogging the lumber to the bed of the machine, the body of the clamp being pivoted, and forced up by the screw, or its equivalent, the dogs being adjustable therein, in the manner set forth. 3d, I claim the method of securing the dog to the bed of the machine by means of the teeth or cogs, and the mortises in the side pieces."

179. For an *Improvement in Operating Dampers of Furnaces;* Daniel Treadwell, Cambridge, Assignor to Herbert H. and Frederick H. Stimpson, Boston, Mass.

Claim.—"I claim using the expansion of the stove or furnace for closing the damper, through the medium of the devices described, or any other combination of devices substantially similar."

180. For an *Improvement in Furnaces for Making Wrought Iron directly from the Ore;* Thomas W. Harvey's (now dec'd., late of the City of New York,) Administrators, Assignors to the Harvey Steel and Iron Company, City of New York.

Claim.—"I claim causing the de-oxydating and de-sulphureting flames and gases, generated in the furnace, to act directly in contact with properly prepared ores of iron (and other metals,) placed upon suitably arranged tables, while, at the same time, a high degree of heat is imparted to the under sides of said tables."

181. For an *Improvement in Cog Gearing;* James A. Bazin, Canton, Assignor to Alfred B. Ely, Boston, Massachusetts.

Claim.—"I claim the manner of manufacturing cog wheels, every alternate tooth being bent in opposite directions from the plane of the plate, in the manner described."

182. For an *Improved Tool Rest for Turning Lathes;* M. H. Merriam, Chelsea, and W. W. Nichols, Assignors to W. W. Nichols & Co., Boston, Massachusetts.

Claim.—"We claim the combination of the elevating screw with the nut and tool post and slide, in which, by turning the nut, you can elevate the tool post and the elevating screw, and, at the same time, the elevating screw is prevented from turning by the

gibs. Also, the groove in the slide, by which the tool post, elevating screw, and nut, are prevented from rising, by pins, or their equivalent, fitted into the nut and running in the groove when the nut is not turned, but when the nut is turned, the tool post can be lowered. We claim the gibs and the elevating screw, as combined with and running in the channels of the slide, by which a vertical movement of the elevating screw is produced, and a rotary prevented."

183. For an *Improved Tool for Boring Recesses for Casters, &c.;* Benjamin F. Graves, Assignor to Wm. C. Knowlton, Boston, Massachusetts.

Claim.—"I do not claim the combining the throat of a chisel with the discharging chip groove of the twist auger, or making the latter to enter directly into the former, whereby its chips are not only discharged through the said throat, but by the pressure exerted on them by the spiral form of the groove of the auger, they are made to aid in the discharge of the other chips from the throat, and thereby prevent the choking of the chips in the throat; but I claim the combination and arrangement of the twist auger, the two cutters or chisels and their throats on the block, so as to operate together and simultaneously, and make a chamber or recess in a piece of wood, of the form substantially as specified. Not meaning to claim a single cutter and a twist auger, as applied to a shaft, so as to merely bore two cylindrical recesses."

184. For an *Improvement in Sewing Machines;* Sidney S. Turner, Westboro,' Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"I claim the arrangement of a hook or hook needle underneath, and so as to work up through the feeding bar, in combination with the arrangement of the presser above the feeding bar, and so as to press downwards towards it, substantially in the manner as described, such enabling me to obtain an important advantage in operating by the single chain stitch sewing machine. And, in combination with the mechanism for giving the vertical movements to the needle, the slot, and the screw or pin, (or mechanical equivalents therefor,) for producing reciprocating semi-rotative movements of the needle during the vertical movement of it, substantially as described."

185. For an *Improvement in Machines for Casting Metallic Eyes or Mail of Heddles for Looms;* Jacob Senneff, Philadelphia, Pennsylvania.

Claim.—"I claim, 1st, The method of casting the eyes or mails on the strands of yarn, or other material, by inserting the yarns successively within a mould secured on a vibrating frame operated at the proper intervals of time, by means of the eccentric cams, said mould being opened at times to disengage the mail therefrom, and provided with a core for forming the eye in the mail, and capable of being withdrawn therefrom before the mould opens. 2d, I claim the manner of operating the core so as to enable it to be so withdrawn from the eye of the mail after the same is formed, and whilst it is firmly embraced within the mould by means of the spring and screws, operating in the manner described. 3d, I claim the core carrier, resting in a notch formed in the top of the spring, and having pins on its face which pass through slots in the mould plates and spring for moving the core horizontally from the stationary half of the mould, and keeping it midway between the mould plates, when they are opened by the lever, and preventing it being thrown violently either way. 4th, I claim the manner of operating the heddle frame holder, by means of the eccentric cams on the shaft, capable of being moved longitudinally over the grooves in said shaft, right angled levers to which the heddle frame is secured, and spiral springs for keeping the ends of the levers always in contact with the eccentric cams; and, in combination therewith, I claim the screw shaft and clamps, and the adjustable gearing at the ends of the screw and main driving shafts."

186. For an *Improvement in Machines for Rolling Shoulders on Axles;* Wm. Van Anden, Poughkeepsie, New York.

Claim.—"I claim the arrangement of the cam rollers, having the reduced surfaces with the guide and feeding tube or box, through the hollow space of which I am enabled to put in the blank bar of iron, and withdraw the finished axle without displacing the forming rollers, or cams, or feeding tube, or box."

187. For an *Improved Steam Valve;* Robert Ross, Philadelphia, Pennsylvania.

Claim.—"I claim the mode of constructing the valve, the same consisting in the loose or detached valve and stem or guide, and combined with the hollow valve rod."

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188. For an *Improvement in Hog Pens;* R. M. Abbe, Thompsonville, Connecticut.

Claim.—"I claim the swinging guard of the pen, in the manner described."

189. For an *Improvement in Cultivators;* W. T. Bazemore, County of Bibb, Georgia.

Claim.—"I claim the form of the hoes, and the arrangement of the rods, by which the hoes are made adjustable, and yet may be held stationary."

190. For an *Improvement in Washing Machines;* Wm. Biddle, LaFayette, Indiana.

Claim.—"I claim the combination of the vibrating bar and vibrating wash board with the lever, the vibrating wash board having its jointed attachment nearer to the centre of motion of the lever than the bar, so that in the motion of the lever back and forth, the clothes shall be griped and released."

191. For an *Improvement in Maize Harvesters;* G. A. Bruce, Mechanicsburgh, Ill.

Claim.—"I claim the combination and arrangement of the oblique revolving cutters, revolving inclined directing shafts, bending and holding arms, and inclined guides."

192. For an *Improvement in Spirit Levels;* Lebbeus Brooks, Great Falls, N. H.

Claim.—"I do not claim the combination of a circular divided limb or plate and a spirit level with a bar or beam; but I claim the combination therewith of an index bar, its divided sectoral arc or limb, and its locking plate and spring catch, or the mechanical equivalents for such locking plate and catch."

193. For an *Improved Window Blind Holder;* E. W. Bullard, Hardwick, Mass.

Claim.—"I claim a blind fastener, consisting of the swivel box, with its projection or hasp, turning freely upon, and when the blind is opened or closed, rigidly held by, the angular rod, the said rod having a bearing upon which it swings in the projecting plates."

194. For an *Improvement in Fastening Skirts to Saddle Trees;* Julius C. Dickey, Sandy Hill, New York.

Claim.—"I claim the combination of the teeth upon the elastic clamp plate, by which means it is held immovable in its position upon the leather, with one or more screws, or their equivalent, to draw the spring clamp plate and jockey plate together, for fastening the skirt to the saddle tree, whether the jockey plate be adjustable, or otherwise."

195. For a *Stave Machine;* Isaac B. Dudrey, Athens, Ohio.

Claim.—"I claim the mode of sawing logs or blocks both ways, by means of two circular saws, so arranged and operated that the saws shall cut alternately in opposite directions by being carried to and from the log or block as it moves back and forth, using therefor any well known mechanical means for effecting the same."

196. For an *Improved Stave Machine;* Isaac B. Dudrey, Athens, Ohio.

Claim.—"I claim the employment of two knives within the curved jaws of a vibrating cutter head for cutting the staves both ways, that is, in the back and forth motion of the cutter head, and in combination therewith, I claim the curved guides or guards for holding the stave when the same has passed the feed rollers."

197. For an *Improvement in Ploughs;* O. G. Ewings, Heart Prairie, Wisconsin.

Claim.—"I claim the jointed beam, in combination with the adjusting screws."

198. For an *Improvement in Manure and Lime Spreaders;* Joseph W. Fawkes, Christiana, Pennsylvania.

Claim.—"I claim constructing the hopper with a swing diaphragm or dividing board, by which the material intended for spreading is prevented from arching. Also, the arrangement and combination of the moving breakers or pulverizers (actuated by the device, as described,) with the rollers, for the more effectual distribution of the contents of the hopper."

199. For an *Improved Method of Guiding Cross-Cut Saws;* Richard Fanning, Clarksfield, Ohio.

Claim.—"I claim, 1st, The hanging of the saw frame in the sash beam by means of a vertical slot, the curvilinear slot and the guides, so that a backward and forward movement of the saw in a direct line is effected, in combination with a rocking movement of

the same. 2d, The combination of the hand lever with the sash beam, for the purpose of regulating, at pleasure, the feed of the saw. 3d, The arrangement of the sash beam so as to be elevated or depressed by turning on the pivot or journal, in combination with the movable frame sliding in the grooves, for the purpose of rendering the saw adjustable to and capable of operating upon logs, or timber of any dimensions, and in various positions, while, at the same time, the movement of the saw is always kept in a line with the direction of the pitman, whatever may be the size or position of the timber to be cut."

200. For an *Improvement in Leather Splitting Machines;* Joseph F. Flanders and Jeremiah A. Marden, Newburyport, Massachusetts.

Claim.—"We claim the use of the continuously revolving or endless belt knife, as applied to machines for splitting leather."

201. For an *Improvement in Bedsteads for Invalids;* J. T. Forbes, Coburg, Canada West; patented in Canada, February 2, 1834.

Claim.—"I claim, in combination with the arrangement of the said shaft, gear and rock shafts, the rock shaft with its attachments, by which the invalid can move the head and foot boards himself."

202. For an *Improvement in Cast Hinges;* Nelson Gates, Cincinnati, Ohio.

Claim.—"I claim the employment, within any number of joints in the knuckle of a hinge, of several metal washers, which are of concavo-convex, or other form, which renders them capable, without any assistance, of serving as a pivot or centre of the hinge."

203. For an *Improvement in Slide Valves for Steam Engines;* John Gleason, Northfield, Vermont.

Claim.—"I claim, 1st, The valve, constructed in combination with the cavities in the covering plate and the enlargement of the steam ports. 2d, In combination with the cavities in the covering plate and the passages in the valve, I claim the safety valves placed on the top plate, for the purpose of allowing the steam to escape from the cylinder into the steam chest, when the pressure in the former exceeds that in the latter."

204. For an *Improvement in the Manufacture of India Rubber;* Dan. Hayward, Providence, Rhode Island.

Claim.—"I claim the improvement in the process of vulcanizing native india rubber, or rubber once vulcanized compounded with other articles, which consists in heating and curing them with steam and under pressure, and in regulating the application of steam and the induration of the product by the introduction of steam and water."

205. For an *Improvement in Seed Planters;* S. M. Hockman, Toms' Brook, Virginia.

Claim.—"I claim the inclined traversing or agitated screen, or its equivalent, to separate the refuse or other matter which is too large to pass through the openings which graduate the quantity spread upon the ground, and thereby prevent such openings from becoming choked. I am aware that radial scores on a plane surface are described and represented in Francis Van Doren's patent of the 13th of April, 1852, which I do not claim; but what I do claim is, making radial scores on a somewhat convex surface, so as to distribute the grain and manure more uniformly."

206. For an *Improvement in Manure Excavators;* A. R. Hurst, Harrisburgh, Pa.

Claim.—"I claim the combination and arrangement of the swinging toothed cross bar, carriage, and swinging stop bar, so as to form an implement for excavating or loosening and separating the particles of manure with ease and facility."

207. For an *Improvement in Seed Planters;* John H. King, Jr., Georgetown, D. C.

Claim.—"I do not claim solid scatterers, such as are used in the lime spreader of J. Hatch, patented August 17, 1835, and also shown in the rejected application of M. D. Wells; neither do I lay any claim to the use of sieves or screens above the hopper; but what I claim is, the employment of the adjustable scatterer, as described, for insuring the even distribution of the various seed and manures passed through the apparatus."

208. For an *Improvement in Lamp Fillers;* C. R. Landmann, City of New York.

Claim.—"I claim the use of the safety filling apparatus, in combination with a filler case."

209. For an *Improvement in Dies for Making Augers;* Ezra L'Hommedieu, Chester, Connecticut.

Claim.—"I claim the peculiar arrangement of the shank entrance of the matrix, that face of it against which the hollow surface of the auger head rests and is formed, and the male die which forms the hollow or recess of the head, the same enabling me to make an auger head not only with the whole of its recess stamped or formed by dies, but having its shank at the proper turning angle with respect to it."

210. For an *Improvement in Harrows;* J. G. McCauley, Stone Bridge, Virginia.

Claim.—"I claim the constructing the double tooth so that one portion may operate on the ground, and the other be in reserve, and also serve as a shank to confine the tooth to the beam, in connexion with the band and key."

211. For an *Improvement in Binding Folder;* John B. Nichols, Lynn, Mass.

Claim.—"I claim the binding folder, (made to guide and fold,) whether used in connexion with a sewing machine or with any other mode of fastening the binding after it is folded and applied."

212. For an *Improvement in Ploughs for Planting Potatoes;* Whitman Price, Goldsborough, North Carolina.

Claim.—"I claim the particular form of skimmer plate, in combination with mould boards, tree, and shovel."

213. For an *Improvement in Seed Planters;* Wm. Redick, Uniontown, Pennsylvania.

Claim.—"I claim the specific arrangement of the cams on the axle, the markers on the periphery of the carrying wheel, and the valves at or near the bottoms of the seeding tubes, with their several operative parts, for the purpose of causing regularity in the marking and dropping of the grain, regardless of the varied speed of the horses drawing the machine."

214. For *Improved Saw Mill Dogs;* Titus H. Russell, Taftsville, Vermont.

Claim.—"I claim the device to keep the hinges of the dogs tight, and thereby more effectually maintain the straightness of the saw kerfs, and uniformity in the thickness of the lumber. Also, the construction of the slide which carries the dog of the head block with a broad platform to support the dog firmly against lateral pressure, and a long narrow arm to extend back of the saw race to the opposite end of the block, the wide and narrow portions of the slide moving on parallel guide rails of corresponding width, whereby the dog, while necessarily limited to a short support on that end of the head block on which it rests, is by this supplementary slide arm seated as firmly on the block as if its slide could be made to extend across the saw race, thus avoiding the binding and other difficulties which have heretofore existed for want of length and firmness in the sliding dogs of the head blocks."

215. For an *Improved Method of Tenoning Spokes;* R. L. Sibbet, Shippensburgh, Pa.

Claim.—"I claim securing a series of spokes upon a board or plate provided with ledges or projections, adjustable gauge block, guide strip, cross piece, cross bar, and block."

216. For an *Improvement in Corn Shellers;* Andrew J. Smith, Piqua, Ohio.

Claim.—"I claim the yielding guard board, having its rear edge somewhat elevated and hinged to the frame, and resting by its front edge upon the rear portion of the shaking continuous carrier, so as constantly to fill the varying interval between the said carrier and the shelling concave."

217. For a *Puppet Valve for Hydraulic Rams;* Joseph C. Strode, West Chester, Pa.

Claim.—"I claim the construction of puppet valves of hydraulic rams with the upper part of the valve sliding in contact with the sides of the valve chamber, and the part made conical or tapering."

218. For an *Improvement in Chairs for Exercising;* J. Stevens, Chicopee Falls, Mass.

Claim.—"I claim a nursery chair for exercising, amusing, and weighing young children, having its parts arranged as described."

219. For an *Improvement in Breast Cups;* Elisha Waters, Troy, New York.

Claim.—"I claim connecting the chamber of the diaphragm pump with the breast cup, by means of the curved exhaust tube, by which the said breast cup can be nearly filled with milk from the breast, without allowing any portion of its contents to flow into the chamber of the pump, which prevents the necessity of frequently removing the cup from the breast whilst using the instrument. Also, the arrangement of the said breast cup and curved exhaust tube with the within described diaphragm pump, by which the patient is enabled to use the instrument without the aid of an assistant."

220. For an *Improved Horse Shoeing Apparatus;* Noah Warlick, La Fayette, Ala.

Claim.—"I claim the head piece, with the adjustable slide, for adapting the apparatus to hoofs of every size."

221. For an *Improved Machine for Cutting Tenons;* Charles P. S. Wardwell, Lake Village, New Hampshire.

Claim.—"I claim the manner of combining and arranging the squaring off saw, vertical shoulder saws, and horizontal tenon saws, or horizontal saws and cutters combined, so as to constitute a machine which is capable of completing the tenon or tenons before the rail is discharged. 2d, The manner of combining and arranging the saw arbor, swinging frame, slotted segment, lever and set screw, for the purpose of facilitating the operation of adjusting the shoulder saws or tenoning saws. 3d, The employment of one or more cutters between the horizontal tenon saws, in combination with the shoulder saws, for the purpose of cutting two or more tenons on each of the rail at one operation."

222. For an *Improved Hydraulic Ram;* Joseph D. West, City of New York.

Claim.—"I claim having two valves placed at the ends of a rod, the valves being fitted at the ends of passages which are connected by branch pipes to a main pipe leading from the spring or source."

223. For an *Improvement in Counter Twist Speeders;* J. Whitehead, Manchester, Va.

Claim.—"I claim the combination of the upper bobbin shaft with the curved overlapping bobbin bars."

224. For an *Improvement in Nail Machines;* John Woolton, Boonton, New Jersey.

Claim.—"I claim the two pairs of segmental rolls, combined so that the first pair brings the nail or spike nearly or quite to the desired form, and the second may complete it, and by their reversed position finish off the finned, feathered, or ragged corners which were formed by the junction of the former rolls."

225. For an *Improved Governor for Wind Mills;* Daniel Halladay, Ellington, Conn.

Claim.—"I claim attaching the spindles of the wings or sails to a sliding head, by means of the levers, or their equivalents, and operating said head by means of the lever, or its equivalent, and a governor of any proper construction, for the purpose of giving the desired obliquity to the wings or sails, and thereby insuring an equal motion of power during the variable velocity of the wind."

226. For a *Method of Furling and Unfurling Wind Mill Sails;* Thomas C. Vice, Rochester, New York.

Claim.—"I claim the clothing and unclothing of wind mills whilst the vanes thereof are in motion or at rest, by means of an iron rod passing through the main hollow vane shaft, in connexion with a bevel gear and pinions attached to their respective rollers, to which rollers are fastened reefing lines connected with the sails."

227. For an *Improvement in Sewing Machines;* Sidney S. Turner, Westborough, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"I claim constructing the feeding wheel in the form of a toothed annulus or ring gear, or the equivalent thereof, and connecting it with the feeding shaft, by a universal joint or ring, and two sets of journals applied together, whereby the cloth or material to be sewed can be readily turned in any direction without the necessity of lifting the presser or presser wheel, as would be required in the performance of such an operation on various sewing machines."

228. For an *Improvement in Glass Lanterns;* Philemore A. Morley, Assignor to James Bright, Brooklyn, New York.

Claim.—"I claim a lamp and lantern of any desired configuration, when made of glass, and in one piece, as described."

229. For an *Improvement in Lard Lamps;* Dexter H. Chamberlain, Boston, Mass., Assignor to Wm. R. Meshurul, New Haven, Connecticut.

Claim.—"I claim the lamp for burning lard or concrete fatty matters, made with an arrangement of the wick tubes, the lard reservoir, and the supporting bifurcated stand, as described, and with the reservoir applied to the stand so as to turn on centres and be fastened in position under any inclination or elevation of the wick tubes."

230. For a *Machine for Dressing Ship Timber;* James E. Crowell, Assignor to self, Edmund Smith, and Charles T. Stickney, Salem, Massachusetts.

Claim.—"I claim the mode of supporting and guiding the movable carriage which carries the lumber that is to be dressed, such consisting in employing four movable rails, arranged and applied together and made adjustable, so as to make the carriage, during its longitudinal movements, not only have a transverse dipping movement, but also a longitudinal dipping movement, or such movements as will enable it to present to the cutter wheels in a proper manner the waved surface to be dressed."

231. For a *Multiform Moulding Plane;* Thomas Worrall, Assignor to Mifflin Paul, Mount Holly, New Jersey.

Claim.—"I claim the slide attached to a plane by means of plates and screws, which will make that plane capable of working all kinds of grooves, fillester, and mouldings."

ADDITIONAL IMPROVEMENT.

1. For an *Improvement in Harness Saddle Trees;* Thomas Mardock and William C. Kellar, Cincinnati, Ohio; dated Aug. 1, 1854; additional patent dated Oct. 12, 1852.

Claim.—"We claim the construction of harness saddle trees with the loose cantle, in combination with the crupper loop, or its equivalent."

RE-ISSUES FOR AUGUST, 1854.

1. For *Cut Nail from Muntz' Metal;* Samuel L. Crocker, Taunton, Massachusetts; ante-dated August 1, 1854; originally dated April 17, 1849.

Claim.—"I claim a yellow metal nail or spike, made by cutting and heading it in a nail or spike machine, meaning by the term yellow metal, a metal composed of copper and zinc, in the proportions in which they are usually combined in the manufacture of the well known Muntz' sheathing metal."

2. For a *Gold Amalgamator;* William Ball, Chicopee, Massachusetts; dated August 8, 1854; originally dated September 9, 1851.

Claim.—"I claim the combination of the partition (dipping below the surface of the water,) with the lower distributor, provided at the centre with a discharge aperture for the water and light particles, and at the periphery with apertures for the discharge of the water and heavier particles, for the purpose of preventing the escape of gold over the central or waste pipe. Also, the arrangement of the sliding tube ferrule or waste gate directly upon the hollow axle of the lower distributor, the same being for the purpose of regulating the head of water within the said distributor. I am aware that it is not unusual in gold washers to use a succession of baths; therefore, I do not claim such arrangement in general; but I claim arranging the secondary mercury bath, concentric with and below the primary one, in such a manner that the current of water, et cetera, return towards the centre of the apparatus, thereby saving room and causing said currents to pass more slowly. Also, rubbing the pulverized ore into the mercury, in the manner described."

3. For *Improvements in Bank Locks;* A. C. Harig and D. C. Story, Louisville, Ky.; August 22, 1854; originally dated July 25, 1854.

Claim.—"We claim connecting the series of male tumblers with the vibrating portion

of the bolt, in such a manner that all of said tumblers must vibrate with said portion of the bolt, and said portion of the bolt must vibrate with said series of tumblers, whilst any one of said tumblers may be moved endwise independently of said vibrating portion of the bolt, and vice versa, by which they are enabled to be operated in connexion with a series of entirely independent stationary female tumblers that can be adjusted in different positions. 2d, The series of female tumblers, when they are secured in such a manner to the lock case that while they admit of unlimited adjustment to suit the different positions into which any key can be made to throw the series of male tumblers, they are so arranged as to be independent of the longitudinal movements of said male tumblers, or the bolt which is combined with them, and consequently are perfectly protected from injury or disarrangement by said movements, and also from any violence that may be exerted upon the bolt. 3d, In connexion with the said series of male tumblers and the vibrating portion of the belt, arranged and combined in such a manner that they must vibrate with each other, and can be moved lengthwise, independently of each other, we claim the fixed and strongly secured studs, arranged in such positions that the bolt cannot be shot back until the vibrating portion thereof is brought up to the highest point allowed by the matching of the series of male tumblers, with which it is combined with the series of female tumblers that are combined with the lock case, by which, when the bolt is shot out, both series of tumblers are perfectly protected from injury by any violence exerted upon the bolt. 4th, We claim the self-adjusting guard, arranged and operating in the 'usher,' in such a manner that the introduction of powder or picking instruments into the lock through the key hole, is effectually prevented. 5th, We also claim the arrangement of the inclined notch on the 'usher,' with the dog and the bolt moving cam, by which the act of turning the usher to enable the key which it carries to operate the tumblers, will throw the dog into such a position as to prevent the said cam from being brought in contact with the vibrating portion of the bolt during the time said 'usher' is being moved, by which the possibility of laterally 'feeling' the positions of the tumblers whilst the key (or a substitute therefor) is in moving contact with them, is entirely prevented."

Designs for August, 1854.

1. For a *Cooking Stove;* Wm. M. Snow, Providence, R. Island; dated Aug. 8, 1854.

Claim.—"I claim the design for the side plate of a cooking stove."

2. For *Cooking Stoves;* Samuel H. Sailor, Assignor to Abbott & Lawrence, Philadelphia, Pennsylvania; dated August 8, 1854.

Claim.—"I claim the design and arrangement of the ornaments in bas-relief and mouldings on the several plates, for stoves called 'Champion Cook.'"

3. For *Franklin Stoves;* John F. Allen and Joseph Stewart, Assignors to Jas. G. Abbott and A. Lawrence, Philadelphia, Pennsylvania; dated August 8, 1854.

Claim.—"We claim the design of the several ornaments in bas-relief and mouldings on the plates and foot of the stove."

4. For *Cooking Stove;* F. Keller and Elias Young, Cincinnati, O.; dated Aug. 15, 1854.

Claim.—"We claim the general form and proportions combined with the mouldings, figures, and ornaments, as described, the said figures, ornaments, and panels, being in alto, in mezzo, or in bas-relief."

5. For *Fronts of Clock Cases;* Nicholas Muller, City of N. Y.; dated Aug. 29, 1854.

Claim.—"I claim the composition of ornamental work."

6. For *Cooking Stoves;* Amos Paul, Newmarket, N. H.; dated Aug. 29, 1854.

Claim.—"I claim the ornamental configuration for the side and front plates of a cooking stove."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Thoughts on the Caloric Engine. By Thomas Ewbank, Esq.

(Continued from page 285.)

Different opinions may prevail respecting the value of the regenerator as an economizer of heat; there can be but one about this extra and unproductive consumption of the motive fluid. Without a regenerator, the whole charge of the feed pump may be delivered in the expanding chamber, but with it a quantity of air equal to its capacity, is kept back at each stroke of the feed pump from the heating surface or furnace.

If the regenerator compressed air into a smaller volume by heating it, (an impossibility,) it might be what it is claimed to be; or if, like waste steam applied to heat feed water, it did not sensibly alter the volume, it would have some of the virtue ascribed to it. And here we may remark that, its kindred device for applying waste steam is useful, because it does not anticipate expansion of the feed water. This does not take place till the liquid reaches the chamber of expansion. Suppose the waste heat of a steam engine *all* saved, and that it dilated the feed water into steam; what then? Why, as no expansion would then be effected in the boiler, the steam engine, like the caloric one under similar circumstances, would stand stock still. Instead of exchanging watery vapor for water, it would receive the same thin material it gave out. The engine would have no capital to work on. The operation would be the same as passing money out of one hand into the other. Thus, in the steam as in the caloric engine, the effect of expanding the motive fluid before it enters the place of expansion, is injurious in proportion to the expansion, and fatal when fully carried out.

The disputes maintained about the value of the regenerator, in American and foreign Journals, will never put the matter at rest. Let the proper demonstrator, experiment, be called in. Let a disinterested party work the large model engine in New York, to the limits of its power *with* the regenerator, and then under precisely the same circumstances *without* it. The margin of alleged profits is so wide that the truth, more or less clear and potent, must appear at once. Why an experimentum crucis of the kind has not been submitted to and even courted, we do not understand, since it is the quickest, surest, and only mode of definitely determining the value of the caloric engine. Why theorize, argue and quarrel for months about the weight of a piece of metal, when the scales are at your elbows?

Like other important problems in mechanical science, this one of force repeating itself by means of heat, might be solved in the laboratory of one of our public institutions, and with simple apparatus.

P. S. It is claimed for the caloric engine, that it is legibly endorsed by nature. One or two more passages from Sargent will show Captain Ericsson's peculiar views of and deductions from natural forces. We know that with some gentlemen, nothing more was wanting, after this

publication, to convince them that the true question was, "will nature turn aside from her own path, and enter the one into which the author of the caloric engine invites her?"

"The prescribed limits of a lecture like the present, will not permit me to follow the deeply interesting analogies, traced by Ericsson, between the principle of the caloric engine, and that of animate and terrestrial force. Some of his views and calculations on the subject, however, I cannot omit to present to this audience, chiefly to meet the objections of those who imagine that they can detect, in the caloric engine, principles that involve the chimera of the perpetual motion.

"The sophist accounts for the continued reproduction of the forces expended in nature, by what he calls a nice balance. If this expression fail to convey a distinct idea to those who hear it, it is probably because no very distinct idea on the subject exists in the mind of him who employs it. He imagines that all force exerted in nature is productive of an equivalent counter force; but how nature makes this counter force subservient, he cannot explain. Were his doctrine true, the principle of the caloric engine would very much resemble that of the perpetual motion; for its object is the production of a continual force almost without reference to the amount of the original exciting cause. Surprising as this may appear, the truth of it is manifested by the principal operating forces in nature, nearly the whole of which, as Ericsson contends, in a strictly mechanical view, are wasted, or, in other words, are exerted without producing any useful or available counter effect. And yet nature has ever at her command an unlimited amount of force.

"To illustrate the amount of this force, I will present one or two calculations by Ericsson, that may excite the astonishment of all who have not had their attention particularly directed to this subject."

He then refers to the force of running streams; instances the fall of water at Niagara, as equalling the power of 15 millions of horses, which may be multiplied hundreds of times by other rivers, and observes that this stupendous force is kept up without any observable decay in itself or in its source, while, to obtain an equal amount by steam, would consume three hundred millions of tons of coal annually.

"By keeping up a force equivalent to a few millions of horse power in our steam engines, we are fast exhausting our mineral store houses; while nature, in constantly exerting a force a million of times greater, causes no change any where that is perceptible to the most rigid scrutiny. Here, then, we have a caloric engine on a vast scale, and a *regenerator* that is susceptible of no improvement.

"The forces to which I have hitherto alluded, many will ascribe to solar influence; a term by which they merely assign a remote location to the acting cause, but fail to explain it. To meet this class of reasoners, Ericsson has prepared another calculation, based upon those forces in *animate* nature, for the production of which solar influence is not absolutely necessary. This calculation estimates the amount of force constantly exerted by animate nature, as equivalent to that of an engine of 100,000,000 of horses power. * * * Hence, it follows that, with *our* present imperfect means of producing mechanical power, we should require *two thousand millions* of tons annually, to exert a force equal to that of animate nature. And yet animate nature perpeually maintains this force without any perceptible permanent change.

"We cannot but assume it (the maintenance of this force,) depends solely on the mechanical laws of nature; and in this view, we are led, irresistibly, to the conclusion that there exists in nature, a principle of absolute reproduction of mechanical force. * * * However imperfect may be the principle of Ericsson's caloric engine, yet it resembles the sublime reproducing principle of nature." pp. 59-64.

He who, aspiring beyond the present, boldly ventures into new regions in search of, and succeeds in bringing in, a new force, who tames and trains it into the habits of a popular laborer, will ever be deemed a genius and a patriot of the first order. A greater glory is not reserved for man than would be his, because a more beneficent gift could not be conferred on his species. Like other prime desiderata, this is not to be

had cheaply. Difficulties of no common kind are to be overcome ere it be reached.

Shy and recluse, it will be hard to find, and harder still to capture and subdue. Unlike the high imaginings of those whose labors are confined to marble and canvas, the engineer cannot move a step beyond nature; the principles he has to do with are inflexible as adamant. Poets and painters can throw to the winds the law of equality of cause and effect, while he breaks down the moment he attempts to stretch or ignore it. Not even preternatural efforts, perseverance, and inventive resource, can then avail him. The pleasing dream of success may be prolonged, it *cannot* be fulfilled.

NOTE.—The caloric engine, it is said, is now about to appear in a new form. Condensed air is to be used: the results must, of course, be the same. No preliminary treatment of air, and no amount of mechanical ingenuity expended on it, can draw from it a virtue it does not possess.

Washington, April 8, 1854.

For the Journal of the Franklin Institute.

Memorandum of Experiments made on the 14th, 15th and 16th April, 1854, with two Jonval Turbines, built by Emile Geyelin, Philadelphia, and erected in the Social Cotton Mill belonging to Messrs. Dexter, Ballou & Co., Woonsocket, Rhode Island.

The experiments were made in presence of Messrs. Oren A. Ballou, S. L. Wild, Superintendent of the Mill, Arnold Jillson, Head Machinist, Emile Geyelin, and several Manufacturers, and other gentlemen interested in the result.

The experiments were begun on the 14th of April, with the test of the amount of machinery the largest of the two Jonval Turbines would drive with full gate open, or all the water on, which it could use.

On the next days, April 15th and 16th, both Turbines were experimented upon for the purpose of ascertaining the per centage of power produced by each Turbine separately. The mode adopted to obtain said per centage, was,

1st. To determine the correct amount of cubic feet of water each Turbine would use per minute, with full gate open, when the other was entirely closed. Then, by multiplying the number of cubic feet obtained by the specific gravity of a cubic foot of water; and, further, by multiplying said result by the amount of fall of water in feet, we obtained the theoretical power of the water. The peculiar formation of the race-way leading the water to the Turbines of the mill, (being a regular trench of equal breadth and depth, between well made cemented walls, and cemented bottom, and of some 300 feet in length,) was well adapted to obtain the accurate amount of cubic feet of water each Turbine used during the respective experiments. A float, made of boards the size of a section of the race-way, balanced so as to float in a vertical position and transversal to the length of race-way, afforded a rare opportunity to obtain said data with entire accuracy. The general mode being by means of waste-boards or orifices under a certain pressure, and thus being

obliged to refer to tables containing coefficients, which are always more or less subject to errors in their application, owing to slight variations in the shape of orifices or waste-boards.

2d. Having thus obtained (by means of the float) a correct result of the number of cubic feet used, we obtain the effective power produced by the hydraulic motor, by means of a dynamometer of Prony applied to the main horizontal line shaft of the mill. The mode of trial and accuracy of this apparatus are too well known to require further notice. It is, however, to be remarked that, owing to the peculiar locality of the apparatus on said line shaft, we were obliged to bring the weight suspended at the extremity of the lever over a pulley, thus creating a friction, which we ascertained by a counter-balance.

It is further to be remarked that the actual per centages produced by each Turbine, are somewhat greater than the following calculations will show, owing to the fact that the actual motion and power of the Turbines had to be transmitted from the Turbine shaft to the line shaft by means of a pair of mortised bevel wheels, which, in addition to the four bearings of said line shaft, absorbed some power, which the dynamometer could not, of course, indicate. The amount of power necessary for the transmission of 100 horse power at a velocity of 135 revolutions per minute through said gearing, we had no means of ascertaining; but it would be safe to say that the actual per centage of the Turbine must have been from 1 to 1½ per cent. greater than what was obtained by the dynamometer itself.

On April 14th, 1854, the large Turbine was started, separately, and the small one closed and detached from the line shaft. This was done for the purpose of showing the amount of machinery it would drive with the right speed, when fully loaded and the gate wide open.

The machinery was counted by Mr. Seth L. Wild, Mr. Arnold Jillson, and Emile Geyelin, and was as follows:—

72	Cards, 36 inches each; 2 lappers, 36 inches; 1 willow or whipper, 3 beaters each; 4 railway heads; 8 speeders, or English fly frames, 5 fine, of 160 spindles each, and 3 coarse, of 80 spindles; making in all, ...	1,040
2	Drawing frames of 4 heads each; 8 boss rollers.	
4	Spoolers; in all 320 spindles.	
4	Dressers.	
4	Warpers.	
4	Pair of self-acting mules of 1728 spindles each, }	
1	" " " 1200 " " } . .	8,112
33	Throstle spinning frames, spindles in warps, making in all, .	2,448
	Total Spindles, .	10,560
138	Looms at 116 picks.	
	All the shafting for 15,000 spindles and 300 looms.	

Data obtained from the measurement of amount of water when the large Turbine alone was in operation, with full gate open, and at the time when the dynamometer was applied at the line shaft:

As stated above, the mode adopted for the measurement of the quantity of water was, by means of a float, which was put transversely in the race-way, and left to float in a vertical position towards the Turbine. At each side we had a man to prevent any tendency of deviating from

the position in which it was intended to float. After being fairly started in its course towards the Turbine, it was repeatedly tried, and found that it traveled 135 feet in four minutes.

Velocity of water,	135 feet in 4 minutes	=	33·75 feet per minute.
Width of raceway,	19 feet 11 inches	=	19·91 feet.
Depth of raceway,	5 " 5 "	=	5·415 "
Section of raceway,	19·91 × 5·415	=	107·81 square feet.

Quantity water used per min. = (107·81 × 33·75), or 3638·58 cub. ft. per min.
Fall of water during the experiment, 20 feet 3 inches = 20·25.

Data obtained by the dynamometer being applied to the line shaft instead of the Turbine shaft itself:

The proportions of the bevel wheels are—

Mortise wheel on Turbine shaft,	75 teeth.
Pinions on line shaft,	51 "

Owing to the greater facility of counting, the speed was taken on the Turbine shaft itself, and requiring, therefore, in the following calculations, to be augmented in the ratio of the above-named mortise bevel wheels. Radius of lever of dynamometer, or length of arm of brake, 11 feet 10 inches; number of revolutions of Turbine shaft, 122 per minute, giving $\frac{122 \times 75}{51} = 179{\cdot}40$ speed of the line shaft. Net weight attached to the end of the lever, 310 pounds.

Experiments made on the Small Jonval Turbine, on the afternoon of the 15th of April.

The amount of water was measured with the same float and exactly in the same manner as at the experiment of the large Jonval Turbine; further, the dynamometer was left in the same position on the line shaft, and at noon the large Turbine was detached, and the small one brought in connexion with the said line shaft.

Data of measurement of water at the trial of the small Turbine:

Velocity of water, or speed at which the float traveled in raceway,			18·70 ft per min.
Width of raceway,	19 feet 11 inches	=	19·91
Depth " during the time of the experiments,	6 feet.		
Section "	19·91 × 6	=	119·46 square feet.
Quantity of water absorbed,	= 119·46 × 18·70	=	2233·90 cb. ft pr mn.
Fall of water during the experiments,	20 feet 7 inches	=	20·58.

Data obtained in experiment No. 1, when the dynamometer was applied to the line shaft in connexion with the small Turbine:

The speed was again counted on the Turbine shaft itself, and was found to be from 139 to 140 revolutions per minute.

Mortise bevel wheel on Turbine shaft,	64 teeth.
Pinion on line shaft,	51 "
Number of revolutions on Turbine shaft,	139·50

$\frac{139{\cdot}50 \times 64}{51} = 175$ R. as speed of line shaft.

The radius of lever of dynamometer remained the same as in the experiment of the large Turbine, or	11 feet 10 inches.
Net weight attached to the end of the lever,	179½ lbs.

Data obtained in experiment No. 2, when the dynamometer was applied to the line shaft, in connexion with the small Turbine:

The speed was again counted on the Turbine shaft, and was found to be 133 revolutions per minute.

$$\frac{133 \times 64}{51} = 166{\cdot}90 \text{ R. as speed of line shaft.}$$

The radius of lever remained the same, 11 feet 10 inches; net weight attached at the end of lever, 192½ lbs.

During experiment No. 2, small Turbine, the amount of water used, and fall, was supposed to be the same as during experiment No. 1.

19·91 × 6 × 18·70 = 2230·90 cubic feet per minute; fall, 20 feet 7 inches = 20·58.

Experiment on Large Turbine.

Calculation of water power, (theoretically,) $\frac{3638{\cdot}58 \times 62{\cdot}5 \text{ lbs. pr. cu. ft.} \times 20{\cdot}25 \text{ ft. fall.}}{33000}$

= 139·55 horse power.

Calculations of Power obtained by Dynamometer from the Large Turbine.

Radius of lever, . . . 11 feet 10 inches, or 11·833

Circumference, $= 2\pi R = 23{\cdot}666 \times 3{\cdot}1416 = 74{\cdot}349$ feet, or 74·35 feet.

Number of revolutions per minute . . . = 179·40

$$\text{Power} = \frac{C \times N. \text{ of Rev.} \times w}{33000} = \frac{74{\cdot}35 \times 179{\cdot}40 \times 310{\cdot}00}{33000} = 125{\cdot}30 \text{ horse power.}$$

Theoretical horse power of the water, 139·50 horse power.

Actual horse power as obtained by dynamometer, 125·30 " "

——— 0·8098 or 0·81 per cent.

Experiment on Small Turbine, No. 1.

Calculation of water power $= \frac{2230{\cdot}90 \times 62{\cdot}5 \times 20{\cdot}58}{33000}$. Fall in feet = 87·07 h. power.

Calculation of Power obtained by Dynamometer.

Radius of lever, . . . 11 feet 10 inches = 11·833

Circumference, . . 20 R = 23·666 × 3·1416 = 74·35 feet.

Number of revolutions of line shaft during the experiment, = 1·75

$$\text{Power} = \frac{C \times N. \text{ or } R. \times w}{33000} = \frac{74{\cdot}35 \times 175{\cdot}00 \times 179\frac{1}{2}}{33000} = 70{\cdot}86 \text{ horse power.}$$

Theoretic Horse power of the water, . 87·07

Actual horse power as shown by dynamometer, 70·86

——— per centage = 0·813.

Experiment on Small Turbine, No. 2.

Calculation of water power $= \frac{2230{\cdot}90 \times 62{\cdot}5 \times 20{\cdot}58}{33000} = 87{\cdot}07$ per centage horse power.

Calculation of Power obtained by Dynamometer.

Radius of lever, . . . 11 feet 10 inches = 11·833

Circumference, . . $2\pi R = 23{\cdot}666 \times 3{\cdot}1416 = 74{\cdot}35$ feet.

Number of revolutions per minute, . . = 166·90

Weight suspended at the extremity of the lever, . 192½ lbs.

$$\text{Power} = \frac{C \times N. \text{ of } R. \times w}{33000} = \frac{74{\cdot}35 \times 166{\cdot}90 \times 192{\cdot}50}{33000} = 72{\cdot}38 \text{ horse power.}$$

Horse power by water, . . . 87·07

Horse power by dynamometer, . . . 72·38

——— 0·83 per centage.

Average per centage of both Turbines at all the Experiments.

0·0998
8·813
0·83

———

2·4528 = 0·8176 per cent.

On the Results of a series of Experiments on the Decomposition of Water by the Galvanic Battery, with a view to obtain a constant and brilliant Lime Light. By the Rev. N. J. Callan, Prof. of Nat. Philos. in the Rom. Cath. Coll. Maynooth.*

(Continued from p. 257.)

To estimate the comparative expense of the coke light and the lime light, it is necessary, first, to determine the size of the battery which will produce a brilliant coke light, with that of one, which, by decomposing water, will produce a lime light of equal illuminating power; and secondly, to determine the time each battery will work with a given charge. Although I made a battery of a size which I thought would be most advantageous for producing the coke light, I have not as yet succeeded in determining satisfactorily either of these two points. The battery which I prepared consisted of 60 cast iron cells in which each zinc plate was 4 inches by 2. In the battery which I commonly used, the zinc plates were 4 inches square. I always found that this battery soon destroyed the coke points. On one occasion, about five years ago, I got a coke light sufficient for the gas microscope from a battery of 24 cells, which were only half-filled with acid. Hence I inferred that zinc plates, 2 inches by 4, would be large enough for a brilliant coke light. When the battery of 60 cells, in which the zinc plates were 2 inches by 4, was prepared, I sent the current, first, from thirty of them through a pair of coke points. The light was sufficiently brilliant for all illuminating purposes, but did not last very long. I then changed the connexion that I might try the effect of 40 cells. The light was then both steady and brilliant. I think that this is the smallest, and therefore the least expensive battery, by which, with the aid of a good apparatus for adjusting the coke points, a continuous light of great illuminating power can be obtained. If the plates be smaller, the illuminating power of the coke points will not be sufficient; and if the number of cells be less than 40, the electric current will not have sufficient intensity to pass through the flame between the coke points. With this battery a pair of coke points lasts a long time. I have found that when the battery is not very powerful, the brilliant light comes only from the positive coke point. For, if a coke point and a copper point be used instead of two coke points, and if the coke point be connected with the positive end of the battery, the light is as brilliant as if two coke points were employed. But if the coke point be connected with the negative, and the copper point with the positive end, the light will be worthless. I forgot to make this experiment when I had occasion to use a very powerful battery. I may mention here that with 60 cast iron cells in which the zinc plates were 2 inches by 4, I was able to fuse and deflagrate a round piece of steel $\frac{1}{4}$ inch diameter. Although I made a far greater number of experiments on the lime light than on the coke light, I am not able to state positively the size of the battery, which, by decomposing water, would produce a lime light equal in illuminating power to that of a pair of coke points

* From the Lond., Edin., and Dub. Philos. Mag., Feb., 1854.

ignited by a battery of 40 cast iron cells in which the zinc plates are 2 inches by 4. I can only say that I think it probable that a battery twice, or very nearly twice the size, would be required. With regard to the length of time the two batteries would work with a given charge, I am equally uncertain. In decomposing water, all the cells must be arranged in rows of four each, so that the intensity of the current may not exceed that of 4 cells. Now, when a current is sent from 4 cells through a good conducting fluid, the quantity of electricity which passes through the fluid and through each cell of the battery is only about one-half of the quantity which would pass if the ends of the battery were connected by a short, thick wire. This I have found by the galvanometer. Hence the battery would work about twice as long in the former as in the latter case. When the coke points were ignited by 40 cells, I measured the angle of deviation of the sine galvanometer, and found it to be 31° when the needle was in the axis of the coil, and nearly 10 inches from its centre. When they were ignited by 60 cells, the deviation was 40°. Unfortunately, I did not measure the angle of deviation which would be produced by the current passing directly through the coil of the galvanometer. The experiments were made before my class, and I intended to measure on the next day the angle of deviation which would be produced by the current from 4 cells of the same size, sent through a fluid. I was prevented from making the experiment until I had occasion to re-magnetize the needle, and consequently I cannot now depend on its indications being the same they would have been on the day the battery of 40 and 60 cells was used. I have since tried the effect of a current from four of the cells on the sine galvanometer after passing it through a solution of carbonate of soda, and found that a deflexion of 21½° was produced in the needle of the sine galvanometer. But I am inclined to think that had I made the experiment the day I used the 40 cells, the deflexion would have been considerably less, because the needle was not then so highly magnetized. The impression made by all my experiments inclines me to believe that a battery would work nearly twice as long in decomposing water as in igniting coke points; that, therefore, the coke light and the lime light are nearly equally expensive, but that the former is somewhat more economical. I shall soon have occasion to exhibit a battery of about 250 cast iron cells, and intend then to compare the quantity of electricity which will pass between a pair of coke points ignited by 40 cells, with that which will pass through a thick wire connected with the opposite ends of the same 40 cells. I intended to investigate the decomposing power of the coil, but I must defer the investigation till health and leisure permit me to resume my experiments.

Maynooth College, January 2, 1854.

P. S. I have got a new iron vessel made of a rectangular form, for which I am preparing two sets of electrodes; one for a battery of low intensity, the other for a battery of high intensity. The former will consist of 100 iron plates coated with an alloy of lead and tin; 50 of them (the alternate plates) will be connected with one end of the battery, and the other 50 with the opposite end. The 100 plates will be divided into twenty

groups, each containing 5 plates. Each group will be covered all round with linen, so that the foam produced by the ascent of the gases in the solution of soda may be made to pass through the linen, and that thus the bubbles may be broken. This arrangement of the electrodes will answer for a battery of 60 cast iron cells arranged in fifteen rows of four each, and in which each zinc plate is 6 inches by 4. The quantity of the gases produced by each group of 5 plates will be equal to that which would be produced by 3 cast iron cells, or the $\frac{1}{20}$th of 60. Now I have found that a linen cover on the electrodes prevents all foam when the battery does not contain more than 5 or 6 cells, in which each zinc plate is 6 inches by 4. Therefore, in the arrangement just described there can be no foam. The electrodes for a battery of high intensity will consist of 156 coated iron plates, divided into twelve groups, each containing 13 plates. The 13 plates of each group will form 12 decomposing cells nearly water-tight, and open only at top. The first plate of each group will be connected with one end of the battery, and the last with the opposite end. Hence when the cells are nearly filled with a solution of soda, the voltaic current will pass simultaneously from the first to the last plate of each group, through the intermediate plates and fluid, and produce decomposition in each cell. This arrangement is intended for a battery of 60 cells, in which each zinc plate is 6 inches by 4, all acting in one series. The intensity of the current from this battery will be reduced to that of 5 cells by passing through the 12 decomposing cells. Each group of 13 plates will be covered with linen, which will prevent all foam, because in each group the quantity of the gases will be only equal to that which would be produced by 5 cells or by $\frac{1}{12}$th of 60.

January 25, 1854.

For the Journal of the Franklin Institute.

Notes on Blanchard's Patent Timber Bending Machine. By Wm. H. Shock, Chf. Eng., U. S. Navy.

The Timber Bending Association of New York, having purchased a lot of ground on Green Point, have erected thereon a spacious building with the necessary machinery for bending timber, and may be considered as having commenced operations, in this new and important undertaking, and with the most gratifying prospects of success.

During a recent visit to the establishment, I was gratified as well as pleased in witnessing the working of the machinery. It was truly wonderful to observe with what despatch, and apparent ease, the various pieces of wood were moulded to the desired shape. One of the most important features in the machinery, is its simplicity and cheapness.

In addition to the larger machines, for bending ship-timber, they have several smaller ones for shaping material for furniture, such as table frames, chair bottoms, backs, &c., &c., a specimen of which, I have caused to be forwarded to the Institute for its inspection. They propose, however, to devote their time exclusively to the bending of ship-timber, and some idea may be formed of their operations from the following:—A piece of white oak, 15 feet, 8 inches long, and $10 \times 9\frac{3}{4}$ inches in

section, was bent complete for a ship's futtock, in seven minutes from the time it was taken from the steam bath. Four knee pieces, 7 feet long, $6\frac{1}{2} \times 5\frac{1}{4}$, were taken from the bath, and a right angled knee formed from each piece, requiring three minutes for each. One piece of black walnut, 6 inches wide, one inch thick, and 6 feet long, intended for chair bottom frames, was formed in one minute from the time it was taken from the steam bath.

Experience will no doubt suggest many improvements in the machinery, notwithstanding they seem to think it is just what they require.

They claim for the bent knees, *greater strength* than those of *natural growth*; this is a point, however, which must be decided by experiment, as well as experience. It certainly is an important invention, well suited to the present times, when angular-shaped timber of natural growth for ship-building is becoming so scarce and expensive. It is proper to remark that in bending the futtock-piece and four knees as above stated, not the slightest evidence of fracture or straining of the fibre of the wood was apparent.

It is necessary to retain the pieces bent in braces, until it is cool, at which time it has its permanent set, and I am informed that no exposure to sun or rain affects it, which has been proved by experiment.

I am informed that a series of experiments, by order of the Government, will shortly be made to test the strength of the wood formed by this process.

For the Journal of the Franklin Institute.

Notes, with abstracts from the Steam Log of the Steamer St. Louis, during her late voyage to Havre and back. By Wm. H. Shock, Chf. Eng. U. S. Navy.

The Steamer *St. Louis* was originally built and fitted for the California trade in the Pacific Ocean, but in consequence of the loss of the *Franklin*, upon the coast of Long Island, she was temporarily transferred to the New York and Havre line, to supply the *Franklin's* place, and left New York for Havre, August 1, 1854, with passengers and mails.

The *St. Louis* is a fine working vessel of 1653 tons measurement, rigged as a fore-top-sail schooner, and supplied with two top-beam engines of the following dimensions:

Diameter of cylinder,		50 inches.
Length of stroke,	10 feet.	
Diameter of air pump,		30 inches.
Stroke " "		57 "
Water wheel (ordinary radial)—Diameter,	30 feet.	
Face of water wheel,	9 "	
Width of bucket,		16 inches.
Number of buckets in each wheel,	28.	

She has *Pirssons's Surface Condenser* attached to the *port* engine, and the ordinary jet conductor to the *starboard* engine, and so connected with each other, as to admit of one air-pump discharging both condensers, in the event of accident to one of the pumps, the same in all respects as the Steamer *Sonora*, a sister ship, and described by me in a late paper upon the performance of that vessel during her late cruise to the Pacific.

The performance of the *St. Louis* was highly satisfactory to her officers,

to one of whom, (her Chief Engineer, J. W. Marshall,) I am indebted for the following extracts and notes, taken from her steam log during her late cruise from New York to Havre and back.

Left New York, August 1st, at 9, A. M. Arrived at Cowes, August 13, at 7, A. M., landed mails and passengers, and got under way for Havre. Arrived at Havre at 4·30 on the same afternoon.

From Cowes to Havre, they sustained a loss of 40 minutes, blowing engines, &c., which is included in the above time, making the run to Cowes in 11 days, 22 hours, and to Havre 12 days, 9 hours, 30 minutes, including all detentions. The numbers which here follow are *averages* for each day:

Abstract of Steam Log on Outward Passage.

Date.	Steam.	Revo's.	Distance. Miles.	Coal. Tons.	Saturation. Star'd. Boiler.	Throttle	Vacuum. S.	Vacuum. P.	Cut off. Inches.
Aug. 2,	22	20087	295	26	1¾	Full.	25	25	64
" 3,	18	18874	225	29	1¾	"	25	25	64
" 4,	17	19360	255	28	1¾	"	25	25	64
" 5,	20	20349	255	30	1¾	"	25	25	64
" 6,	21	21215	255	31	1¾	"	25	25	64
" 7,	20	21368	270	32	1¾	"	25	25	64
" 8,	18	21128	255	30	1¾	"	25	25	64
" 9,	18	21218	265	29	1¾	"	25	25	64
" 10,	19	22355	288	30	1¾	"	25	25	64
" 11,	17	21523	260	25	1¾	"	25	25	64
" 12,	17	23428	280	30	1¾	"	25	25	64
" 13,	17	21957	To dock	29	1¾	"	25	25	64

Remarks.—The fresh water from patent condenser was used entirely in port boiler. Coal, Bituminous.

On her return trip to New York, she left Havre for Cowes, at 1·20 P. M., August 30. At 12·20 A. M., August 31, stopped at Cowes for mails and passengers, and at 2·45 A. M., September 1, left Cowes for New York; and arrived at her dock at 1, P. M., September 12, 1854, running the distance in 11 days 10½ hours from Cowes to New York. Whole time from Havre to New York, including stoppages, &c., 13 days, 11 hours, 40 minutes.

Abstract from Return Trip.

Date.	Steam.	Revo's.	Distance. Miles.	Coal. Tons.	Saturation.	Throttle	Vacuum S.	Vacuum P.	Cut off. Inches.
Aug. 31,	20	15777	100	20	1¾	Full.	25¼	25¼	64
Sept. 1,	23	18668	240	23	1¾	Open.	25¼	25¼	64
" 2,	22	19056	260	21	1¾	"	25¼	25¼	64
" 3,	23½	20059	265	28	1¾	"	25¼	25¼	64
" 4,	23	20083	260	33	1¾	"	25¼	25¼	64
" 5,	22	19881	250	28	1¾	"	25¼	25¼	64
" 6,	20½	19807	280	30	1¾	"	25¼	25¼	64
" 7,	23½	21339	260	32	1¾	"	25¼	25¼	64
" 8,	23	21304	240	33	1¾	"	22¼	25¼	64
" 9,	23¾	20708	230	38	1¾	"	25¼	25¼	64
" 10,	22	20460	220	30	1¾	"	25¼	25¼	64
" 11,	19½	21764	297	29	1¾	"	25¼	25¼	64
" 12,	21	21867		29	1¾	"	25¼	25¼	64

Remarks.—Boilers managed same as before. Coal, Welsh.

We have to regret in this case, as with most of our sea steamers, the absence of indicator diagrams, by which only, can we arrive at correct conclusions as to the efficiency of the engines, boilers, &c.

For a full detail of all the dimensions of the *St. Louis*, see *Franklin Institute Journal*, page 353, VOL. XXVII.

For the Journal of the Franklin Institute.

Trial Trip of the Steamer John K. Hammit. By WASHINGTON JONES.

This steamer, built for the Laguayra and Porto Cabello Steam Packet Company, (the particulars of engine and hull will be found in the *Journal of the Franklin Institute*, Vol. xxvii, page 282. The estimated number of turns is there stated to be 26. It should have been 36,) went on the engineer's trial trip, October 21st. The following is an account of her performance and condition at the time:

KETCH RIGGED.—

Draft forward,	7 feet.
" aft,	8 " 6 in.
" mean,	7 " 9 "
Amidship section immersed,	140 sq. ft.

The time of passing the measured distances, pressure of steam, vacuum, and number of revolutions, was carefully noted, and will be found in the subjoined table. The boiler furnishes an ample supply of steam with natural draft, burning bituminous coal.

Time down.	Place.	Pressure of Steam in pounds per gauge.	Vacuum in inches per gauge.	Revolutions of engine.
A. M. 10·31	Navy Yard Shears,	30	26	40½
" 10·46	Powder Piers,	30	26	41½
" 11·22½	Fort,	28	26	41
P. M. 12·21	Chester,	21	26	38

The vessel was rounded to, passing below the bar of Chester island, and headed for the return to the City through the west channel.

Time up.	Place.	Pressure of Steam.	Vacuum.	Revolutions.
P. M. 12·41	Chester,	30	26	42
" 1·24	Fort,	26	26	40½
" 1·42	Powder Pier,	29	26	41
" 2·2	Navy Yard Shears,	30	26	43

The measured distance run to Chester from Navy Yard Shears and back, is thirty miles, to which must be added the opposing current of a strong flood tide, during the run down, and a reduction made for its assistance in returning from Chester to the Fort; the remaining distance was run in nearly slack water. No change was observed in the wind, which blew tolerably strong, and was in favor down, but in opposition

up; the two effects may be considered as neutralizing each other, and be disregarded.

Distance from Navy Yard Shears to Chester,	.		15 miles.
Add for current of 2¼ miles per hour, acting for one hour and fifty minutes,	. . . .		4.6 "
Distance back to Navy Yard Shears,	.	15 miles.	
Deduct for current of latter part of flood tide, per hour during 43 minutes time,	.75 mile	.54 "	
			14·46 "
Actual distance through the water,	.	.	= 34·06 "

Time occupied in running to Chester from Navy Yard Shears,	1 hour	50 min.
" " from " to " " "	1 "	21 "
	3 "	11 "

By dividing is found the average speed of the vessel through the water = 10·7 miles per hour, or 941·6 feet per minute.

The pitch of the propeller at centre of pressure is, 14·71 feet, and it completes two revolutions for one of the engine. By averaging the turns made by the engine, we get for the theoretical progression of the propeller per minute,

	$41\frac{1}{8} \times 2 \times 14.71 =$	1209·9 feet.
Progression of vessel,	.	941·6 "
Slip,	.	268·3 "

or over 22 per cent.

It is expected, that the per centage of slip will be reduced when the vessel is brought to trim more by the head, which will make the angle of the entrance finer. The model of the hull is good; and from the known reputation of the builders, Messrs. J. K. Hammit & Son, has had justice done it in the construction. Not being designed for great speed, the route being short, but a comparatively small amount of engine power was placed in her; so the result of the trial was very satisfactory to contractor as well as builders. She will sail for her destination, to be placed upon her intended route, about the last of October.

For the Journal of the Franklin Institute.

Notes on the Cloud Combination of Steam and Air. By Wm. H. Shock, Chf. Eng., U. S. Navy.

By invitation, I lately visited an establishment in New York, where they have a small engine for driving three of "Hoe's Patent Printing Presses," and in which they use the *Cloud Combination* of *Steam and Air.*

I here submit the facts, collected during my visit, (with two reports made by Horatio Allen, Esq., of New York, annexed,) hoping they will prove an incentive to a further examination of the principles of this phenomena in steam engineering.

The engine used for driving the above presses, is of that class known

as the square engine, 10 inches stroke and about 5 inches diameter. (I had no correct method of arriving at the exact diameter.)

The piston rod is continued above the cross head with reduced diameter, and up through the engine frame, upon which sets the air pump, 10 inch stroke and 2 inches in diameter, forming an arrangement of piston not unlike that of the Worthington pump.

A separate eccentric is used for working the *steam* expansion valve, also, one for working the *air* valve.

The steam chest is the same in all respects, as those usually found on engines with the short slide valve, with the addition, however, of a face on one side of the chest, to admit the air, or, in other words, an air chest on the side, and opening into the steam chest.

The air is compressed, (as shown by gauge,) to exert a pressure, varying from 15 to 20 lbs. per square inch, and is admitted into the cylinder for 1½ inch of the stroke of the piston, and then steam of a pressure of 80 lbs. per square inch for the following two inches, when all communication to the cylinder is closed, the engine making from 65 to 70 revolutions per minute, driving all the *presses*, *but as soon as the air communication to* the cylinder was closed and the operation of the engine depended upon *steam alone*, its speed was immediately reduced, and finally stopped, and it was found that with all the *steam* they could get, it was impossible to drive *one press*.

I am further informed, that the cooler the compressed air enters the chest, the more satisfactory are the results to be obtained, and to that end, it is proposed to immerse the air pump and pipes as far as practicable in a cold bath.

The coal consumed during the working hours (10,) varies from 170 to 200 pounds (anthracite.)

As before stated, Mr. H. Allen conducted a series of experiments, and made reports, of which I have been kindly supplied with copies.

The following appears in the report, dated July, 1854.

"A steam engine, 8-inch diameter of cylinder, and 12-inch stroke, with suitable boiler, was fitted up, and also provided with the means of working an air-pump, and the valves required for introducing air into the cylinder. The revolutions of the engine were controlled by the friction of a pulley. As the same pulley, weight, and appurtenances were used in all cases, and great care was taken to keep a full and uniform supply of water to the surface of the pulley, a great uniformity of resistance was obtained.

"After working the engine as a steam engine at various degrees of expansion, it has been found that, with a pressure of 70 pounds in the boiler, the best results have been obtained by letting on the steam for 2 inches of the stroke.

"With the valves so adjusted, the result of the trials with steam alone, gave 170 revolutions for one pound of coal.

"Having made the trials with steam alone, the same engine was prepared for cloud combination by adding the air-pump and valves.

"In this arrangement, the air was let on for 1½-inch stroke at its commencement, and then steam (boiler pressure 70 pounds,) for the following 2 inches. The performance of the cloud combination, as shown by several trials, exceeded 250 revolutions for one pound of coal.

"In making these trials of the cloud combination, it has been found that when steam of about 60 pounds pressure is combined with air of from 15 to 20 pounds pressure only, there results a pressure from the combination exceeding that of the steam, at least 10 to 15 pounds.

"This important fact was clearly brought out by the pressure gauges attached to the

steam chest, which indicate the pressure of steam, both before the combination and after the combination. An increase of pressure of 15 to 16 pounds is invariably indicated.

"Another manifestation of this increase of pressure, is found in the operation of the check-valve in the steam pipe, through which the steam is introduced. This valve opens with the current of steam. When the engine is used as a steam engine, this valve closes gently by its own weight as soon as the cut-off stops the current of steam, but when the *cloud combination* is being used, this valve closes very soon after the steam is let on, and before the cut-off closes, with a degree of violence that shows there has resulted from the combination of steam and air, an expansive effect much exceeding that of the steam used.

"As the result of the trials referred to, I have to state that the increase of pressure arising from combination of steam and air, is proved beyond a doubt, and that the increased useful effect resulting from this increased pressure, as shown by these trials, is over 50 per cent."

In August, 1854, a larger boiler was substituted for the one used in the above experiments, and the following tabulated report made:—

"I have repeated the trials of cloud combination with same engine, but a larger boiler. The following is a statement of results:

First.—Steam alone.

Steam in boiler.	Steam in chest.	Coal to raise steam.	Coal while running.	Revolutions.
110 lbs.	100 lbs.	156 lbs.	156 lbs.	16,759

"Stopped three times for ten minutes. Time of trial, four and a half hours. Running time, four hours.

"16,759÷156=107 revolutions for 1 lb. coal.

Second.—Cloud.

Boiler.	Chest.	Air.	Coal to raise steam.	Coal while running.	Revolutions.
110 lbs.	100 to 110	18 lbs.	156 lbs.	104 lbs.	19,749

"Running time, four hours.

"19,749÷104=190 revolutions for 1 lb. coal.

"Cut off for steam, at 1½ inch of stroke, expanding 7½ times.

"Cut off for air 1½ inch, and for steam 1½ inch, expanding 4 to 6 times.

"It will be seen, that the performance with steam alone is under as favorable circumstances as can be provided in a high pressure engine. The expansive principle is fully carried out, and nothing is wanting to make the performance by steam alone, a fair standard with which to compare the cloud engine; and this performance has been largely exceeded by the—

"*Cloud Engine.*—I have previously reported the result of former trials, in all which the performance of the cloud engine has much surpassed that of steam alone.

"It therefore appears to me, that but one conclusion can be drawn from these trials, and that is, that by the cloud combination, a very large saving will be effected.

"The means to be used are simple, and involve no difficult mechanical combination.

"What the proportion of saving is to be, remains to be determined by more extensive use, but I am constrained by the facts which have been developed by these trials, to state my belief that the cloud combination will take the place of the high pressure engine, and prove itself one of the most extraordinary and valuable inventions of the age."

That the results observed by Mr. Allen in his experiments with the cloud combination, are most extraordinary, is beyond a doubt, and deserving of further experiments upon a larger scale.

Translated for the Journal of the Franklin Institute.

A Pocket Barometer. By M. C. Brunner, Poggendorff, Annalen, 1854.

This instrument is composed of two parts, which are carried separately, and fitted to each other when the instrument is to be used. One of these pieces, similar to the Forten barometer cistern, is a hollow iron cylinder containing mercury, the level of which can be raised or lowered by the movement of a screw. This reservoir may be closed by a cover when it is to be carried about, and to prevent the mercury from being heated when held in the hand, the cistern is wrapped in woolen stuffs.

The second part is composed of two concentric glass tubes. The external tube, of pretty large diameter, is open below, but hermetically closed at its upper end by a plate of copper traversed by the inner tube, which is open at both ends.

To make an observation, the two pieces are put together by screwing. The level of the mercury is raised by turning the screw of the cistern, and it is evident that at the moment the lower end of the inner tube dips into the mercury, there is, in the annular space inclosed between the two tubes, a certain volume of air, which will be the same in all observations. The level of the mercury in the cistern is raised until it touches an iron point placed at a suitable height. The mass of air is thus reduced to a smaller volume, and in every experiment the diminution of volume is the same. At the same time, by the increase of the elastic force of the interior air, the mercury rises in the central tube, which is open at its upper end, by a quantity which depends on the initial pressure of the atmosphere. To determine exactly the height of the column raised, a rod terminating in a point at its lower end, may be raised or lowered in the inner tube by means of a rack, and a scale fitted to this rod shows the distance of this point, which is made to touch the surface of the mercury in the inner tube, from the point in the cistern, which corresponds to the lower level of the mercury.

If h be the height thus indicated, H the unknown barometric pressure, v and v' the initial and final volumes of the included air, then, if we admit Mariotte's law to be true for air at ordinary pressure,

$$v : v' :: H+h : H. \quad \text{Whence } H = h\frac{v'}{v-v'}.$$

This ratio, $\frac{v'}{v-v'}$, by which h is to be multiplied in order to get the true barometric height, will be constant in all the experiments, and it will suffice to determine this coefficient once for all, by making a comparison with the common barometer.

M. Brunner found the value of this coefficient for his apparatus 4·428. To appreciate the value of this instrument, he compared it a number of times with the common barometer; in the ten comparisons which he has cited, the maximum errors are + 2·1 millimetres and — 0·9 millimetres. He attributes these divergences principally to the changes of temperature which the air may undergo during the observation.

On this proposition, the editor of the *Bibliotheque Universalé de Genêve*

remarks, It appears to us that there is a more important cause of error which may lead to much more considerable differences; it is the state of moisture of the air. While we may admit Mariotte's law for dry air, or air far from saturation, we certainly cannot do so when it is saturated with watery vapor; for then the compression will produce condensation of the water. Let us suppose the experiment made under these circumstances; let us designate, by f, the tension of the vapor of water at saturation, at the temperature at which we are operating, and keep the same notation for the other quantities as before; we shall have $H=\frac{v'}{v-v'}\ h+f$.

So that, if we have determined the constant coefficient with air so dry that there was no condensation, and we wished afterwards to make an observation in air saturated at 36° Cent., (86° Fahr.,) (to take an extreme case,) we should make an error of nearly 31 millimetres. Even without supposing the saturation complete, it is known that in vessels of glass, Mariotte's law ceases to be true long before the point of saturation, in consequence of the hygroscopic attraction of the glass determining a condensation of vapor. It is therefore probable that, if the constant coefficient were determined with a certain degree of dampness, whenever the weather was drier, the pocket barometer would indicate too great, and whenever the weather was damper, too small a height.—*Bib. Univ. de Genève: Arch. des Sciences Physiques, tome* xxvi., p. 162.

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Remarks.—While this reasoning is evidently true, we do not regard the objection as fatal in practice to this very ingenious, and probably very useful instrument; for, by the addition of a chloride of calcium tube, it appears to us easy enough to fill it always with dry air. Ed.

Translated for the Journal of the Franklin Institute.

Apparatus for preserving Telegraphic Apparatus from the disturbing influence of Atmospheric Electricity.

"M. Becquerel presented to the Academy, an apparatus invented by M. Barthelemy Bianchi, intended to preserve telegraphic apparatus from the disturbing influence of atmospheric electricity."

This very simple and easily erected apparatus, consists of a metallic sphere, traversed by the circuit wire, and kept in the centre of another glass sphere, formed of two hemispheres united by a broad copper ring, armed at its inside with equi-distant points directed towards the centre of the metallic sphere, and approaching within a short distance of its surface. The two hemispheres end in sockets, into which the connecting wire passes and is cemented. The lower part of the copper ring is provided with a metallic stop-cock, which permits a vacuum to be made in the apparatus, and kept in it, if it be thought necessary. This stop-cock has a screw-thread which is to receive a metallic rod designed to put the metallic armature into direct connexion with the earth, while the circuit wire, and the sphere which forms part of it, are completely insulated.

With this apparatus it is seen, that all the atmospheric electricity which

comes upon the conducting wire of the telegraph, is transmitted to the ground through the points with which the ring is armed.

Such an apparatus is to be erected at each station; experiment has proved to the author, that when the discharge of a battery of eight jars is passed into a telegraphic conductor provided with this apparatus, the dynamic current is not affected, and all the statical electricity passes into the earth, under the influence of the points.

M. Becquerel in presenting the apparatus, expressed the desire that it should be immediately experimented on, on a large scale, on our telegraphic lines.—*Comptes Rendus de l'Academie des Sciences*, (*Paris*,) 15th May, 1854. p. 877.

For the Journal of the Franklin Institute.

Particulars of the Steamer Pelayo.

Hull built by Wm. H. Webb. Machinery by Pease & Murphy. Intended service, Island of Cuba.

HULL.—

Length on deck, from fore part of stem to after part of stern post above the spar deck,	200 feet.
Breadth of beam at midship section,	31 "
Depth of hold,	14 "
Length of engine and boiler space,	58 "
Draft of water at load line,	10 "
" " below pressure and revolutions,	9 "
Tonnage, Custom house,	830.
Contents of bunkers in tons of coal,	125.
Masts and rig—	Foretopsail Schooner.

ENGINE.—Vertical beam.

Diameter of cylinder,	64 inches.
Length of stroke,	8 feet
Maximum pressure of steam in pounds,	15.
Maximum revolutions per minute,	18.

BOILERS—Two—single return flues.

Length of boilers,	22 feet. 6 inches.
Breadth "	10 " 3 "
Height " exclusive of steam drum,	9 " 6 "
Number of furnaces,	6.
Length of grate bars,	5 feet. 6 inches.
Number of flues,	12 in each.
Internal diameter of flues,	14½ inches.
Heating surface,	2700 sq. feet.
Diameter of smoke pipe,	5 "
Height " including steam chimney,	39 "
Description of coal,	Bituminous.

WATER WHEELS.—

Diameter,	26 feet.
Length of blades,	8 " 6 inches.
Depth,	16 "
Number "	24.

Remarks.—Floor timbers at throats, *molded* 12 in., *sided* 9½ in. Distance of frames apart, *at centres* 30 ins. Floors filled in solid.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Emeu.

Hull built by Robert Napier, Glasgow. Machinery by the same. Owners, Pacific and Australian Steam Navigation Co. Intended service, Panama and Sydney.

HULL.—

Length of keel and fore rake,	257 feet.	
Breadth of beam at midship section,	36 "	6 inches.
Depth of hold,	28 "	6 "
Depth of lower hold,	21 "	
Draft of water at load line,	17 "	
Tonnage, builders' measurement, 1666.		
Area of immersed midship section at this draft,	386 sq. feet.	
Displacement at 15 ft.=1645 tons—at 17½ ft.=2045 tons.		
Contents of bunkers in tons of coal, 900.		
Masts and rig,— Barque.		

ENGINES—Overhead Beam—

Diameter of cylinders,		64 inches.
Length of stroke,	4 feet.	
Maximum pressure of steam in pounds, 15		
Maximum revolutions per minute, 34½=103 of screw.		
" " above pressure and revos., (even keel)	15 "	

BOILERS—Four.—

Length of boilers,	14 feet.	6 inches.
Breadth "	11 "	2 "
Height, " inclusive of steam chimney,	11 "	6 "
Number of furnaces, 12.		
Length of grate bars,	6 feet.	4 inches.
Diameter of smoke pipe,	6 "	
Height " " (above grate bars,)	52 "	6 inches.
Description of coal, Bituminous.		

PROPELLER.—

Diameter, (Griffith's)	12 feet	4 inches.
Pitch,	15 "	
Number, of blades, 2.		

Remarks.—Frames; *shape and dimensions* L $5\times3\times\frac{9}{16}$ and $\frac{7}{16}$ under engines and boilers—distance apart at centres 18 ins. Keel, *dimensions* 10×4 in. Stem, 10×4 in. tapering to 8×2 in. Stern posts, *inner*, below shafts 12×4 in., above shaft 10×4 in., *outer* 8×6 in., tapering to 8×3 in.

Abut joints and double riveted—Strakes, clincher laid and double riveted to 6 feet water line. Floor plates connecting frames, 20 inches deep at keelson and ½ inch thick.

Bulk heads—Four, water-tight, of ½ to ⅜ in.; plates stiffened by angle iron ⌝ $4\times3\times\frac{3}{8}$ in. placed vertically two feet a part.

Coal bunkers—of ⅜ and $\frac{3}{16}$ in. Plates, stiffened with angle iron ⌝ $3\frac{1}{2}\times3\times\frac{3}{8}$ in. placed 2 feet 6 inches apart; ceiled over floors with $\frac{3}{16}$th plates.

Deck plank, *upper*, East India teak 3 in. thick; *main and lower*, yellow pine 3 in.

Speed, 12·56 knots, with and against tide. Hull ceiled to 4 feet water line with elm, 3 inches thick. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Acorn.

Hull built by Capes and Allison, Hoboken. Machinery by Hogg & Delamater, New York. Intended service, Boston and Sandwich.

HULL.—

Length on deck, from fore part of stem to after part of stern post,	120 feet.	
Breadth of beam at midship section, above the main wales,	22 "	
Depth of hold,	7 "	
Draft of water at load line,	7 "	6 inches.
" " " below pressure and revolutions,	7 "	6 "
Masts and rig,	Three masted schooner.	

ENGINE.—Vertical direct.

Diameter of cylinder,		26 inches.
Length of stroke,	2 feet	2 "
Maximum pressure of steam in pounds,	40.	
Maximum revolutions per minute,	60.	
Weight of engine,	15 tons.	

BOILER.—One—return flued.

Length of boiler,	18 feet.	
Breadth "	6 "	6 inches.
Height " exclusive of steam chimney,	7 "	6 "
Weight " without water,	7½ tons.	
Number of furnaces,	one	
Length of grate bars,	5 feet	8 inches.
Number of flues or tubes,	13.	
Internal diameter of flues or tubes,	9 of 8½ ins., 4 of 13 ins.	
Diameter of smoke pipes,		28 inches.
Height, " "	20 feet.	
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per hour,	¼ ton.	

PROPELLER.—

Diameter of screw,	8 feet.	
Length of blades,	2 "	3 inches.
Pitch of screw,	18 "	
Number of blades,	4.	

Remarks.—Floors filled in solid under engine. C. H. H.

For the Journal of the Franklin Institute.

Reply to T. Ewbank's Thoughts on the Caloric Engine. By JOHN H. BLOODGOOD, Esq.

In looking over the September number of the *Journal of the Franklin Institute*, I find an article headed "Thoughts on the Caloric Engine," which, as it is the last of a series of articles which have appeared from time to time from various sources, and almost the only one which essays to meet the subject upon philosophical grounds, instead of by ridicule, merits a reply.

In the article referred to, Mr. Ewbank commences his argument with the assertion that the claims in behalf of the caloric engine necessarily

demand the rejection of previously received theories of heat, in its connexion with power.

Were this so, which I do not admit, it appears to me no sufficient argument against; for a theory, at best, is but an ingenious invention of the mind to explain certain natural phenomena, and liable to be overthrown at any time, should it be found insufficient, under more critical investigation. If facts cannot be reconciled with theory, the latter, and not the former, must give way.

But is it the fact that the principles of this engine are at variance with received theories? Mr. Ewbank states that Capt. Ericsson and his friends claim that, "but for practical difficulties and imperfections attending the construction of a new class of machines, the *whole* heat might be saved from running to waste."

I have known Capt. E., personally, and have often talked with him upon this subject, but have never heard him claim this much; on the contrary, he *positively and most emphatically disclaims* any such idea. What his friends claim, may arise from their misapprehension, but certainly not from his own assertions. He has never, to my knowledge, claimed to retain for future use, *any heat* but that which *has not been expended* in useful effect, (or whose force has not been transferred to matter outside the engine.) The value of this quantity may be variously estimated by different experimenters; for myself, I am fully convinced that the actual force exerted by the best form of steam engine, is very far from expressing the total force existing in the elastic fluid under the given temperature, or the total power of the caloric. Indeed, no body through which a power is exerted, can communicate its *whole* force to another body, except it lose entirely its own motion; and we know that there is still much force remaining in steam on its exit, since it is evidently capable of expansion until it is in equilibrium with the resistance offered by the air, or the smaller resistance of the condenser; and even after this expansion, there still remains heat enough to cause considerable increase of bulk with useful effect in any gas or other matter with which it might be mixed. We have, therefore, certainly lost some part of the value of the heat; and it is this heat, (which has ordinarily to be renewed, together with that actually expended in useful labor,) and *only this*, which Capt. E. expects, or has claimed to save. How much this may amount to, or what may be its mechanical equivalent, I do not now propose to discuss.

It will not, however, be out of place in this connexion, to quote the words of the celebrated Regnault, certainly the highest authority on the subject of caloric now living, to wit: "In air engines, when the motive force is produced by the dilatation which heat produces upon gas in the machine, or by the increase which it produces in its elastic force, the work done at each stroke of the piston will always be proportional to the difference of the quantities of heat in the air entering and leaving; that is to say, the loss of heat by the air in traversing the machine." But, as in the Ericsson system, *the heat which the air gives out, is given up to bodies from which the entering air takes it again, and brings it back to the machine*, we see that, theoretically, *all the heat expended is utilized for*

mechanical work; whilst, in the best steam engine, the heat utilized in mechanical work is not the one-twentieth part of the heat expended.

In physics, a well-known rule holds, that inelastic bodies in motion striking against others, will communicate a force proportioned to their relative momenta; and, when the two are of equal weight, one being at rest, the striking body will yield half its motion to the other, and retain an equal amount. A similar law, with certain limitations, seems to hold good in the transfer of heat from one body to another, so that, as is well known, heat may be *almost*, but *not entirely*, withdrawn from any body by successive contact with cooler matter.

To illustrate my meaning, and its application to the return of heat for useful purposes, let us imagine a series of cups, say ten, placed between two vessels of water, one heated to 200°, the other standing at 50°; let each cup be half filled with water at 50°; then, beginning at the end nearest the hot vessel, fill the cup from that vessel, the quantity required to do this being equal to that already in the cup, the temperature resulting from the mixture will be 125°; again, from this fill the next, it will produce a common temperature of 87·5°, and so on until the last, when the temperature of the water in that cup will not be raised more than the fraction of a degree. If we reverse the operation, taking cold water (at 50°) to begin with, we will find that, on arriving at the hot vessel, it has acquired the temperature of 100°; and if the process be frequently repeated, the gain in one direction, and the loss in the other, will finally reach a constant ratio, resulting in a higher temperature in the water returning to the hot vessel, constantly approaching the degree of heat in that vessel, as the series of cups is extended, *but never equalling it.* Heat, therefore, is obviously capable of return to a great extent, or of being saved; nor would the result be altered in the least, in this respect, were we to apply the expansion, in each successive vessel, to the movement of machinery.

Were we to substitute air for the water, causing it to impart its heat to successive equivalents of any kind of matter, we would obviously obtain an analogous result; and, as before, the return of the heat to a fresh portion, would be independent of any mechanical force exerted by the air, and would certainly be saved. Nor can this result be affected by the mechanical arrangements for freeing the air through the various parts, since the same devices, requiring the same power, will be necessary in simply supplying a reservoir with air to be directly heated by fire before entering the engine, and certainly no one will deny that a surplus of power *can* be thus obtained for moving machinery.

It cannot be denied, however, that in the use of permanent gases, the force consumed in renewing the supply, bears an inconveniently large proportion to the force available for other uses; and, next to the mechanical difficulties in the engines hitherto constructed, this has been made a point of objection most strongly urged by writers on this subject.

But to revert to our original proposition; does the return of heat, as illustrated above, imply a perpetual motion, as stated by Mr. Ewbank? Most certainly not; even were an engine constructed solely with reference to continued motion, without regard to any exertion of power. This plainly appears from what I have shown as the action of a "regenerator;"

for, though the saving may approach, apparently, very nearly the whole quantity of heat demanded, it certainly can never equal it, even leaving out of the consideration the effect of expansion, radiation, &c. Theoretically, it may approach infinitely near that point, but there must still be a difference.

If my assumption as to the value of heat returned be not admissible, how then can we account for an engine being kept in motion for a long period, an hour or more, after all sources of heat except the regenerator and heated parts of the engine have been removed? and this I assert to be a fact.

Mr. Ewbank also compares the force exerted by steam or heated air to that of lifting a weight by a counterpoise somewhat greater, or by animal force. The comparison, as stated, is not a proper one, since he loses sight of the fact that it is not the greater weight, viewed simply as a mass of matter, that lifts the other, but the more subtle force of gravity, a force which has been used over and over again from all eternity, and which bids fair to last as much longer. With regard to animal power, the analogy also fails on account of the new elements connected with vitality, whereby the contractile force of the muscles becomes exhausted: and, furthermore, we have no means of ascertaining what increase of combustion is necessary in the lungs (beyond what is required merely to sustain life,) to compensate for the exertion of power in doing any given amount of labor. Such forces as gravity, heat, or electricity, I conceive are indestructible in their very nature, and are only lost to our sense, by being, under certain circumstances, in a state of equilibrium, or balanced by opposite forces.

Finally, as to the statement that the regenerator acts as a serious drag on the engine, by resisting the passage of air, I have only to say that this exists only to a very trifling degree, for in an experiment which I witnessed to test this very fact, the obstruction in passing through 250 wire disks, was only sufficient to change the level of a mercury gauge about one-quarter of an inch, too inconsiderable to be of serious moment, compared to the whole power.

New York, October 6th, 1854.

For the Journal of the Franklin Institute.

The Caloric Engine. By J. Ericsson, Esq.

A very learned Professor of mathematics in the North of Europe, recently published a pamphlet in relation to this motor, in which he clearly demonstrated, that caloric cannot be made to exert an infinite amount of mechanical force. On presenting a copy of his work to an eminent engineer for his approbation, this gentleman returned civilities by presenting the Professor with a printed copy of the claims of the inventor, under which, several European patents had been granted. The *savant* was much mortified to learn by the document thus presented to him, that he had wasted time by disproving a proposition not advanced. This is only one instance out of hundreds, that might be cited, of uncalled-for criticism on this subject. Such misconceptions on the part of those who have

only had access to newspaper statements, popular lectures, &c., are by no means surprising. That Mr. Ewbank should have fallen into a similar error is, however, unaccountable; for he, as Commissioner of Patents, signed a document, in which the following distinct declaration of the inventor is contained: "whilst in the steam engine the caloric is constantly wasted by being passed into the condenser, or by being carried off into the atmosphere, in my improved engine, the caloric is employed over and over again, enabling me to dispense with combustibles, *excepting for the purpose of restoring the heat lost by the expansion of the acting medium, and that lost by radiation*, also, for the purpose of *making good* the small deficiency *unavoidable* in the transfer and retransfer of the caloric." In the face of so clear a statement, it is palpable injustice to attribute to the inventor, the absurd proposition of producing an unlimited amount of mechanical force by caloric. Moreover, an accurate estimate of the quantity of fuel requisite to meet the several sources of loss here distinctly pointed out as inseparable from the caloric engine, viz: the loss by radiation, the loss by fall of temperature during expansion, and loss attending the process of transfer in the regenerator, will, assuredly, not furnish good excuse for confounding the caloric engine with the chimera of "perpetual motion." At the same time, it may be readily proved, that the caloric, which is thus in part wasted, and in part rendered unfit for producing motive power in this engine, calls for but a small consumption of fuel. Accordingly, the production of a given amount of power will require but a small consumption compared with the present steam engine.

Mr. Ewbank states that heat cannot be used over again. It has been shown by the practical working of several caloric engines, that the quantity of heat contained in the air of the working cylinder is much greater than the quantity generated by the combustion in the furnaces during each stroke. The excess, therefore, must be supplied by the regenerator, which receives its caloric solely from the air escaping from the working cylinder. It would be sheer sophistry to say that this is not employing heat over again. Treating heat as motion only, and adopting corresponding language, would render the explanation of the operation of the machine quite unintelligible. Otherwise, the writer has no objection to deal with caloric as force, for his opportunities of observing its nature and effects, have been most extensive, and he long ago arrived at the conclusion, that heat is motion. The superficial investigator alone, will deem this hypothesis fatal to the caloric engine. A thorough investigation of the principle of the engine will show, that (supposing *caloric* and *motion* synonymous,) the proposition is not to reproduce the motion once imparted, or parted with, but simply to employ, or exhaust, the whole motion, the entire force resulting from the exciting cause. How imperfectly this is accomplished in the present steam engine, needs not be pointed out, *high* and *low* temperature being alike unavailable, whilst in the caloric engine the exciting energy, the force of caloric, may be rendered available from 540° down to atmospheric temperature.

Mr. Ewbank's practical mode of illustrating the subject by showing that "there is no making pounds out of pennies in the currency of force," calls for the following kindred illustration: The force of caloric being

represented by a stream of water running down a declivity of a certain height, the present steam engine will be truthfully represented by a small overshot wheel placed somewhere down the stream; the caloric engine, at the same time, will be as truthfully represented by a Turbine wheel placed at the bottom, employing the force of the entire height of the fall. The wheel first mentioned, has been tinkered at for half a century, and at last rendered tolerably perfect, its admirers telling us with exultation, that "it spans the entire stream, and that not a drop can pass without doing full duty." They forget, in their admiration, that the stream is running to waste above and below.

The writer desires to be clearly understood to assert, that the power developed by the caloric engine, demands no further consumption of fuel than that requisite to meet the several sources of loss of heat enumerated in the foregoing statement, viz: fall of temperature by expansion of the acting medium in the working cylinder, radiation of heat, and loss attending the process of transfer of the caloric in the regenerator. The first named loss, calculation will determine; the other two have been ascertained experimentally. The result establishes a very small consumption of fuel compared with the present steam engine. The saving is effected mainly, by using the heat over again in the regenerator, *by which*, in every instance, the air entering the working cylinder has been elevated to 400°, often as high as 500°, *before receiving any heat from the furnaces.*

New York, October 9, 1854.

Remarks by the Editor.—We publish the remarks of Messrs. Ericsson and Bloodgood, although it is rather too late to begin to reply to the articles previously published, after the total failure of the project. Nor do we agree with the gentlemen as to the view they take of the question. Mr. Bloodgood incorrectly asserts that Mr. Ewbank's article is "almost the only one which essays to meet the subject upon philosophical grounds, instead of by ridicule." The ridicule which was thrown upon the project in some of the later articles which have appeared in this *Journal*, was caused by the attempts of his friends (for we considered the feasted and champagned reporters who were permitted to attend his trip, in this light,) to present each successive failure as an entire success. The principle, as announced in the patent, was fairly developed and rationally discussed in former articles, to which no reply was attempted.

We do not accuse Mr. Ericsson of having ever asserted that his engine was, in principle, a perpetual motion. But this claim was decidedly and frequently made in the various newspaper articles which reported his banquets, and for which we cannot but consider him responsible, since they were published under his auspices, (on his account, as it were,) and without public remonstrance on his part, so far as we have ever heard.

The experiment we always regarded as an interesting one, and regretted the care with which all impartial and competent men were excluded from an opportunity of witnessing the trials. Now, that the result has been a complete failure, it is, we imagine, useless to resume the discussion, until new features are developed in the machine, or capitalists are found ready to throw away their money on a new experiment.

For the Journal of the Franklin Institute.

Particulars of an Iron Steam Barge.

Hull built by Reaney, Neaffie & Co.; machinery by the same. Owners, Baltimore and Philadelphia Steamboat Company. Intended service, freighting between Baltimore and Philadelphia.

HULL.—

Length on deck,		148 feet.
Breadth of beam,		23 "
Depth of hold,		8 "
Contents of bunkers in tons of coal,	10	
Masts, two, to be used as derricks for taking in cargo.		

ENGINES.—One.—Direct acting, inverted cylinder.

Diameter of cylinder,		28 inches.
Length of stroke,		26 "
Maximum pressure of steam in pounds per sq. in.,	80	
Cut-off from commencement of stroke,	13	
Weight of engines in pounds, estimated,	29,000	

BOILERS.—One.—Flue and return flue.

Length of boiler,		20 feet 6 inches.
Breadth "		6 " 6 "
Height " exclusive of steam drum,		7 " 9 "
Cubic feet of steam drum,	225	
Weight of boilers in lbs., with water, estimated,	32,000	
Number of furnaces,	2	
Breadth of furnaces,		3 "
Length of grate bars,		5 " 6 "
Heating surface,		700 square feet.
Consumption of coal per hour, estimated,	336 lbs.	

PROPELLERS.—

Diameter,		8 feet 1 inch.
Length of blades,		2 " 8 "
Depth "		15 "
Number "	4	
Average revolutions per minute, estimated,	75	

Remarks.—Frames, $\frac{3}{4} \times 3\frac{1}{2}$ inches, and 15 and 18 inches apart; 7 strakes of plates from keel to gunwale; thickness of plates $\frac{3}{8}$ and $\frac{1}{4}$.

W. J.

For the Journal of the Franklin Institute.

Steamboat Explosions.

Whenever we have an account of a boiler explosion, we hear the cry for a week or so for new laws, and more stringent provisions, careful inspection, &c., &c., and the General, State, and Municipal Governments are in turn solicited for their interference, and abused for their negligence, until the epidemic excitement has run its course in a few days, and all the clamor subsides, to be re-awakened by a new catastrophe. How far we want new laws, or how far the present regulations are available, may, we think, be gathered by glancing at the result of the examination of an engineer of a Mississippi boat which exploded, killing, in the opinion of the captain, from eighteen to twenty persons.

The character of the explosion may be collected from the subjoined testimony of the Captain, and the Government Inspector:

"*September*, 1854.

"EDMUND F. DIX, sworn on the part and behalf of the United States, says: That he was Captain or Master of the steamer *Timour*, No. 2, on the 26th day of August, 1854, and at the time of the explosion of the boilers of said steamer, about three miles below Jefferson City, on the Missouri river. The explosion took place between 10 and 11 o'clock, A. M., of the said day; after I had landed the boat, I walked down to the boiler deck; I had been there probably half a minute when the boilers exploded; the next place I found myself was on the forecastle; all three of the boilers exploded, and the decks were broken down; I heard one tremendous crash at the time of the explosion, and that was all that I recollect of hearing; everything that I saw about the boat afterward, seemed to be dry, and the persons injured seemed to be burnt rather than scalded; I had not noticed anything unusual in the condition of the steam on the boat; there had been no extra exertions to increase the steam, previous to the explosion, to my knowledge; from the time of the landing of the boat up to the explosion, it could not have been more than three minutes; my opinion is, that there were from eighteen to twenty persons killed by the explosion; I noticed a piece of the boiler on the side of the hill, one hundred and fifty or two hundred yards from where the boat was lying; I have been steamboating for fifteen years; from my experience and observation, such as it is, I have formed the opinion that the explosion was caused by want of water in the boilers.

"*Cross-Examined* by Captain Hudson.—There was no unusual head of steam at or up to the time of the explosion; the boilers of the *Timour* had been in use about three years; all of the boilers were at one time so much burnt that one sheet had to be taken out of each of them, and new sheets put in; this burning was caused by there being very little water in the boilers; at another time, one of the boilers was heated in the same way, so that the sheet had to be taken out; one of the boilers might be so burned without affecting the others; Mr. M'Cord and Mr. Scott, the persons who are now under examination here, were the two engineers on the boat at the time of the explosion; Mr. M'Cord had the reputation of being a careful man; I did not know Mr. Scott until he came on the boat as second engineer.

"Being *re-examined*, says: That the boilers were inspected once by the Government Inspectors since the last burning above spoken of took place, and at the time of repairing the said burns, all the injured portions were removed.

"(Signed,) Capt. E. F. DIX."

"DAVIS EMBREE, sworn, says: In the performance of my duties as Supervising Inspector of Steamboats, I went to the wreck of the *Timour*, No. 2, near Jefferson City, Missouri, to make a personal examination; all the boilers, three in number, had exploded; the main deck of the boat, from the forward boiler beam to the cylinder timbers, a space of about thirty feet, was completely broken; the plank shears and guards for that length were also broken or blown overboard; the lattice bulkhead and string piece that supported the beams were also broken away, and I have reason to suppose that some of the planks of the hull were blown off, as it is in evidence that the boat sunk immediately: it is shown that nearly the whole force of the explosion was upwards and downwards: the main deck, cabin floor, hurricane deck, and officers' rooms, (Texas,) were all cut off nearly even with the cylinder timbers, or only a few feet back of where the boilers stood: the forward part of the boiler deck, part of the hurricane deck, and the chimneys, I am informed, were thrown upon the forecastle; the decks, beams, cabins, and every part of the wood work under and over the boilers, appear to be literally broken up into splinters; parts of some of the boilers and flues are scattered about the shore and deck; some pieces of the flues are flattened, and others are not so; the after-head of the starboard boiler lies upon the deck between the cylinder timbers, with parts of the flues and more than one ring of the boilers attached; the forward heads of the boilers being of cast iron, are much broken; the flues of the middle boiler, with part of the after-head attached, are across the boat near the cylinder timbers, the one pointing to the shore, and the other into the river. Part of the after-head of the larboard boiler is on shore, with some of the shell attached; two large fragments of this boiler were thrown upon the bluff, equal to about six sheets, and weighing, by estimate, 450 pounds. It struck a tree, as near as could be judged, 200 feet in height, and in a horizontal direction, 160 yards from the boat; the other, which would weigh about 150 pounds, was 20 or 30 feet nearer the

boat; one large fragment of iron, containing about the equivalent of four sheets, was in the hold of the boat; it had been torn open at the bottom of the boiler; all the large fragments examined, with one exception, were also torn open at the bottom of the boilers; the stand pipes were broken short off at the cross or supply pipe; the mud receivers and safety valve were not found; the doctor was overset, but not broken; the valves were all examined, and found in good order; the heavy line scales were generally thrown off of the iron where there was a flattening of flues, or straightening of the shell; but on some parts of the bottom of the shell of the boilers, I found heavy lime scales, which I judge to be between one-eighth and three-sixteenths of an inch thick; these were what we steamboatmen called low-water scales; the flues that were not flattened were heavily coated with lime. I saw no water line, or mark of low water on the flues, or on the head of the boiler on the deck of the boat. I suppose if the water had been low in the boilers, the lime scales in the tops of the flues would have shown it; but I heated a part of a flue that was heavily coated with lime until it burnt a wad of wet hemp to ashes, and it appeared to have no effect upon the lime scales. The lime seems to adhere to the iron as paint does to wood; this is the low-water lime scale; the high-water lime scale is more rough and porous. I brought away some pieces of the iron of the exploded boilers, but have not yet had time to have its strength tested. I have the promise of the exact height and distance from the boat to where the fragment of iron struck the tree, by the Superintendent of the Pacific Railroad.

"From the facts in evidence in this case, we must draw our conclusions as to the cause of this melancholy disaster. It is an extraordinary occurrence, the time being just after stopping the boat, is unusual; had it occurred on starting the boat, after it had been lying some time at shore, we might attribute it to the accumulation of surcharged or unsaturated steam, as fully treated upon in the *Western Boatman;* to the adhering of the safety valve by glutinous matter, or to some other such cause; but in this case there was not time to accumulate an undue head of steam, if the evidence be true. There was no evidence of a want of water, unless the fact that there was an explosion be that evidence, which I cannot admit in all cases; although I admit it is the general cause of explosions. In this case there is direct and positive testimony of there having been plenty of water in the boilers. This is supported by the fact that there was not a person on board, be his experience great or otherwise, that noticed any change or variation in the sound of the steam whatever; they were all as unconscious of danger as we are now, sitting in this room; we must, therefore, look to some other cause for the event. I cannot agree with the witness, Chappell, that it was an instantaneous and unaccountable accumulation of power; if so, steam is not under human control, even for ordinary purposes. Every effort should be made, and every faculty of the human mind exerted to its utmost tension, before we come to such conclusion. First, then, is there any necessity for looking for greater force than is admitted to have existed in the boilers of the *Timour*, No. 2, at the time of the explosion, to account for all the results that followed? There were three boilers, each 28 feet long, and 40 inches in diameter, with a pressure of 150 pounds to the square inch; 40 inches in diameter is 120 inches in circumference; 28 feet is 336 inches in length; these, being multiplied, make 42,000 square inches; multiplied by 150 pounds to the square inch, makes 6,300,000 pounds for one boiler, and for three boilers makes 18,900,000 pounds, or 9450 tons. There were, then, 9450 tons of pressure chained within the boilers of the *Timour*, at the time of her landing. If we can show that this tremendous force was instantaneously let loose upon the deck of the boat, will it not account for all that we have seen? If we deduct the one-half, three-fourths, or even eight-ninths of this force, as having escaped sideways and endways, we have yet more than a thousand tons of direct force to mash the deck of the boat to atoms, and send fragments of the boiler 200 feet high and 160 yards horizontally. That the boilers of the *Timour* did split open at their bottom, is evidenced by the force of the steam having operated upward and downward, and not endwards to any great extent; that the explosion was almost instantaneous, is gathered from the fact that most of the persons on board recollected but one tremendous shock, while others think there were two shocks or concussions. The latter I think probable, and that the middle boiler first gave way. It would in that case drive the others outward, and tear them from the fastenings to the mud-receiver and cross-pipe. When the boilers were thus fractured, they may have torn from end to end in a single instant, because the whole force of the steam in that direction would be applied to break fibre after fibre, like the tearing of cloth, thread by thread, making no difference with what speed it would be effected. I draw this conclusion from the direction in which the large fragments of the larboard boiler were thrown upon the bluff, while the starboard boiler, with the exception of the after-head, was probably

thrown into the river. The shell of the middle boiler was thrown, no one knows where, while the flues of it were thrown in opposite directions, and now remain fast to part of the after-head, upon the boat. These things indicate an almost exact upward and downward tendency of the force, and a balancing of the materials upon which it operated; I therefore believe that the cause of the explosion was the injury of the iron of the bottoms of the boilers by being covered with lime, a partial non-conductor of heat; the iron when thus exposed has the fibre destroyed, and becomes granulated or crystallized and weakened, and that the boilers give way in the weakest part.

"*Cross-Examined.*—States that the quantity of steam allowed on the steamer *Timour*, No. 2. was 150 pounds to the square inch, as appears by the certificate of Inspectors; the boilers on this boat were one grade thinner than usual, though not so thin as many that have passed inspection; I profess to be an engineer, though never acted regularly in that capacity on a steamboat; it is some ten or twelve years since I have been on the river as boatman at all; I never was engaged in boating on the Missouri river; boilers used on the Missouri river are more liable to be injured or affected by lime scales than other waters with which I am acquainted; scales will constantly be forming in navigating the Missouri river, unless there be some remedy applied to prevent it; the giving away of the boilers, or any one of them, in any portion or part, with the usual head of steam, might have produced an explosion, and the appearance of the wreck just the same as made by the explosion in this case.

"(Signed,) DAVIS EMBREE."

To show the competency of the men employed, we have the testimony of an assistant engineer, that—

"I do not believe that the explosion took place from a gradual increase of pressure, but from an instantaneous pressure *caused by some means which has never been discovered.*" "I do not think it possible for any gradual increase of steam to have torn a set of boilers into so *many irregular shaped fragments.*"

On the strength of this evidence, the U. S. Commissioner decided to discharge the defendants, "the said evidence not being sufficient to show that they or either of them were guilty of inattention, negligence, or misconduct, in the discharge of their duties."

What use, then, of making laws, the administration of which is to result in such a solemn farce? If these engineers were not guilty, then what must an engineer do or neglect, in order to convince the Commissioner of his guilt?

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*Vulcanized Stone.**

A fresh invention has been patented for hardening the soft stones of the country. Specimens have been exhibited of great hardness, susceptible of high polish, which preserve a sharp arris, and are stated to be proof against the alternations of our climate, and to withstand not only the London atmosphere, but even the action of the strongest acids. The proprietors allege that, by a solution, chemically prepared, and laid on with a brush in dry weather, the decay of old buildings may be arrested; and the material acted on, whether stone, compo, or brick, be made perfectly non-absorbent.

The specification says,—"It is proposed (in all cases where it is practicable) in applying any indurating mixtures, to inclose the stone or other materials to be operated upon in an air tight chamber, and exhaust, or partially exhaust, the same, and then allow the indurating substance, whether hot or cold, to trickle down, or flow into the chamber, to fill the vacuum, the effect of which will be that the liquid indurating substance will readily find its way into the pores of the stone or other material, and become incorporated therewith.

* From the London Builder, No. 576.

Mixture No. 1.—The composition of this solution is as follows:—56 parts, by weight, of sulphur, dissolved by the aid of steam heat, or dry heat, in 44 parts dilute vinegar, or acetic acid containing 17 parts of acid to 8 of water.

In preparing indurating mixtures to be applied to the exteriors and interiors of buildings, whether possessing a surface of brick, stone, cement, or plaster, I employ the following ingredients:—Shellac, 14 parts, by weight; seed lac, 14 parts; coarse turpentine, one part; pyroligneous spirit, 40 parts;"—and other mixtures.

For the Journal of the Franklin Institute.

Particulars of the Steamer Plymouth Rock.

Hull built by J. Simonson, New York; machinery by Allaire Works. Owners, New Jersey Transportation Company. Intended service, New York and Stonington.

HULL.—			
Length on deck,		330 feet.	
Breadth of beam at midship section, (moulded,)		40 "	
Depth of hold,		12 "	8 inches.
Draft of water at deep load line,		6 "	
Masts and rig, none.			
ENGINES.			
Diameter of cylinders,			76 inches.
Length of stroke,		12 feet.	
BOILERS.—Two.			
Length of boilers,		38 feet.	
Breadth "		12 "	6 inches.
Height " exclusive of steam chimney,		11 "	8 "
Number of furnaces,	4		
Length of grate bars,		8 "	
Number of flues or tubes,	13		
Length " "	24 and 30 "		
Diameter of smoke pipes,		5 "	
Description of coal,	Anthracite.		
Draft,	Blast.		
PADDLE WHEELS.			
Diameter,		37 feet.	
Length of blades,		10 "	
Depth "		2 "	6 inches.
Number "	30		

Remarks.—Boilers on guards; Hull strapped with iron; Floor timbers moulded 18 inches; sided 7 and 10 inches, and set 24 inches apart at centres.

C. H. H.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 19, 1854.

George W. Conarroe, President, pro tem., in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.